

THE IRON AGE

New York July 6, 1916

JULY 7 1916
UNIV. OF MICHIGAN
LIBRARY



THE FILE YOU WILL EVENTUALLY USE—AS PERFECT AS WILL AND
SKILL CAN MAKE—CLEAN, STRONG, SHARP TEETH

DELTA FILE WORKS

PHILADELPHIA

USED IN EVERY SHOP WHERE ECONOMY AND EFFICIENCY ARE PRACTICED

U. S. A.



TABLE OF CONTENTS - - -

33

Buyers' Index Section.....296
Contract Work Section.....281

ADVERTISING INDEX - - -

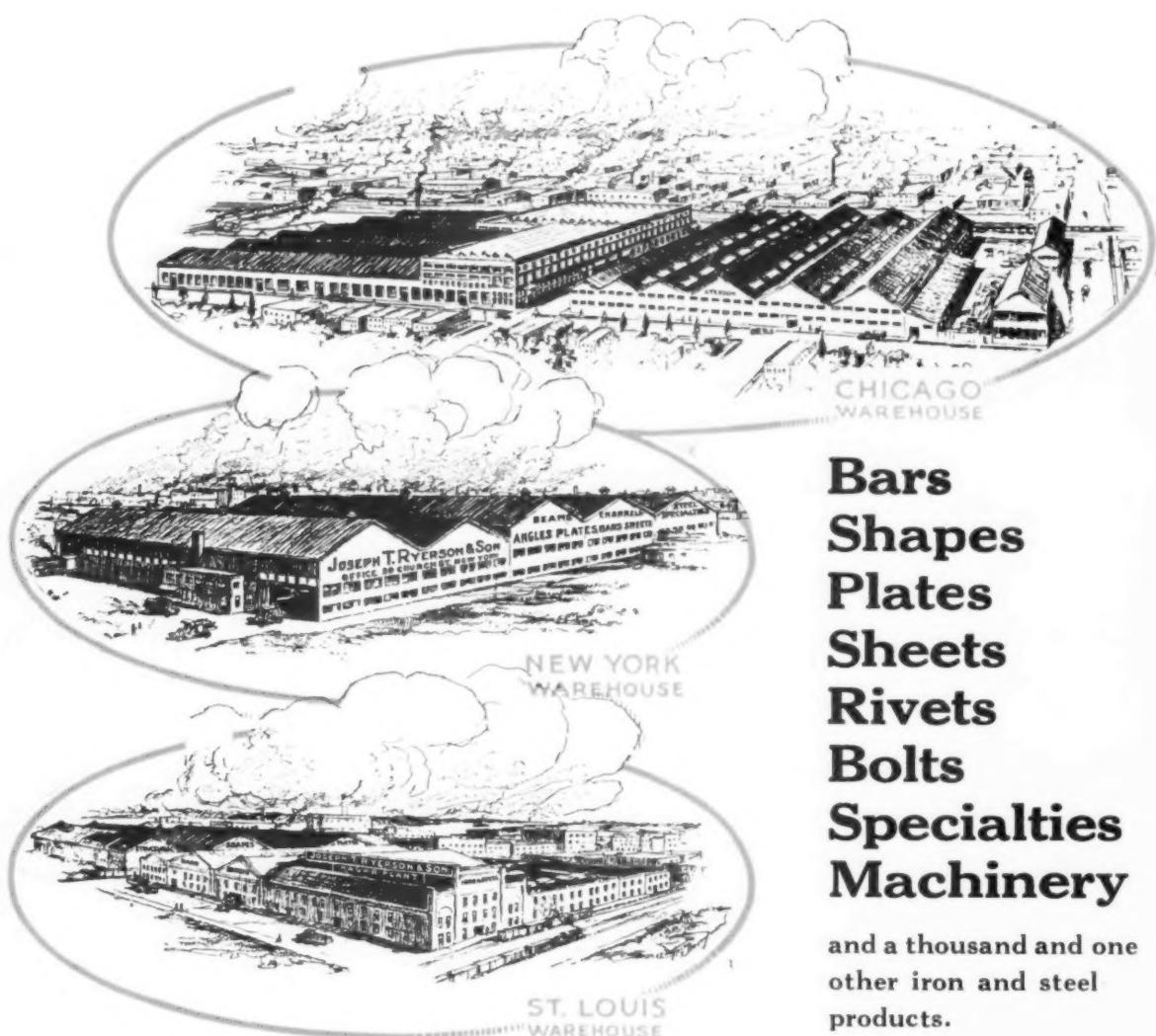
309

Help and Situations Wanted.....293
Business Opportunities.....290

Clearing House.....261
Professional Notices.....295

We Have Steel for You

**Large and complete Stocks in Ryerson
Warehouses for immediate shipment**



**Bars
Shapes
Plates
Sheets
Rivets
Bolts
Specialties
Machinery**

and a thousand and one
other iron and steel
products.

CHICAGO
RAILWAY
EXCHANGE
WAREHOUSES
16TH AND
ROCKWELL STS.

NEW YORK
30 CHURCH ST
WAREHOUSES
WEST SIDE AVE.
JERSEY CITY

ESTABLISHED 1842 INCORPORATED 1888

JOSEPH T. RYERSON & SON

CLYDE M. CARR, PRESIDENT JOSEPH T. RYERSON, VICE-PRES.

IRON STEEL MACHINERY

NEW YORK

CHICAGO

ST. LOUIS

ST. LOUIS
HAGAR PLANT
2208 N. 2ND ST.
PITTSBURG
CLEVELAND
DETROIT
MILWAUKEE
MINNEAPOLIS
KANSAS CITY
HOUSTON

THE IRON AGE

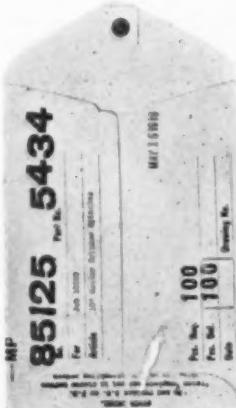
New York, July 6, 1916

ESTABLISHED 1855

VOL. 98 : NO. 1

Dispatch System of Norton Grinding Company

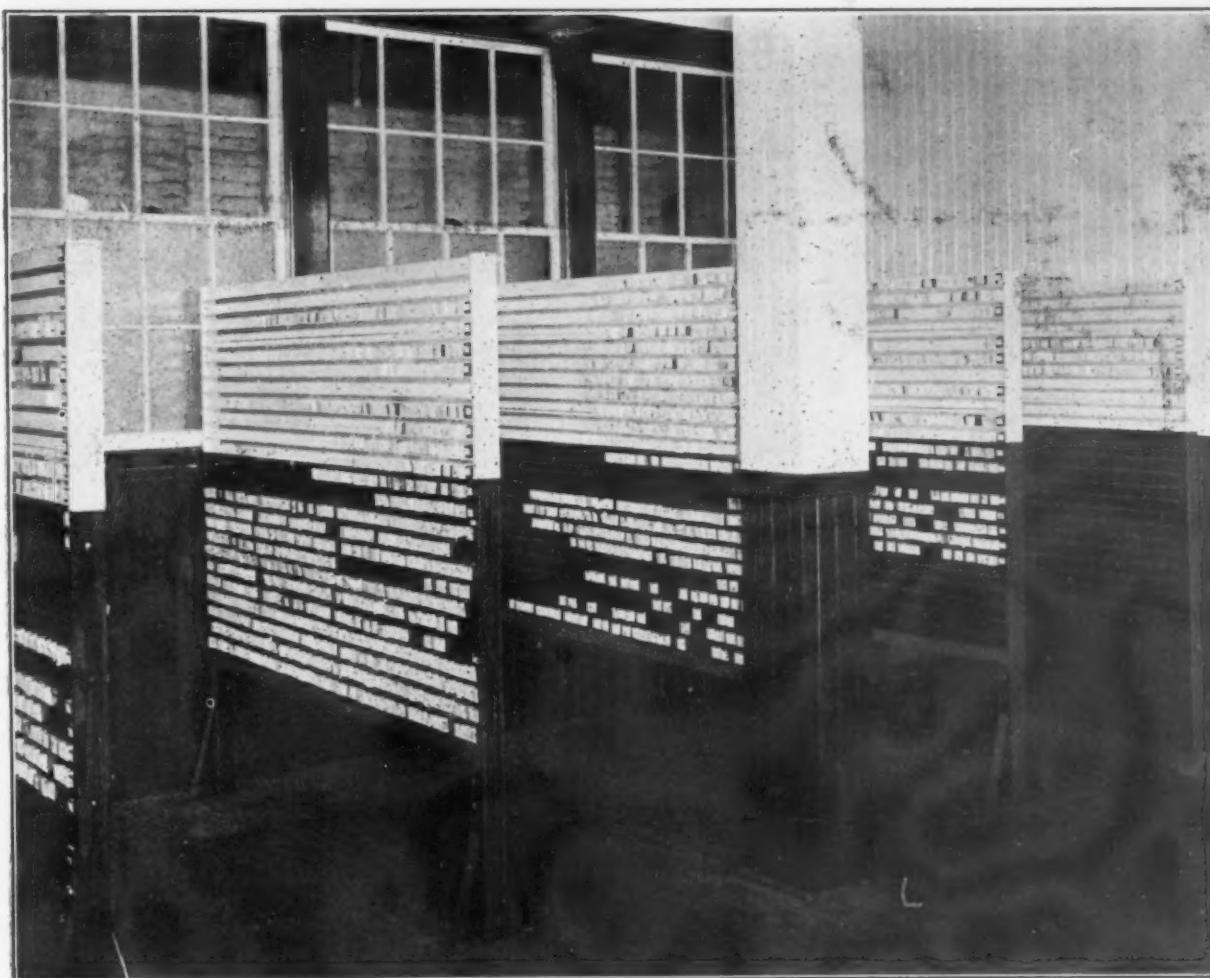
Planning Board Visualizes Jobs Ahead of Each Machine, and Routing Sheets Indicate Dimensions and Limits of Each Operation



A COMBINATION of a planning board, which visualizes the jobs scheduled against each machine, and of routing sheets, that cover directions and limits of each machining operation, is a feature of the system for dispatching work through the plant of the Norton Grinding Company, Worcester, Mass.

Also, instead of the ordinary traveler that generally accompanies the material in the factory, an envelope

ope is used. This envelope, here shown, gives all the information usually furnished by the tag traveler. On the back of the envelope is evidence that it has been to the various departments necessary. It contains a blueprint of the finished piece, there being an individual print for each piece. Accompanying the blue-print are routing sheets shown among the illustrations. These routing sheets are in consecutive order



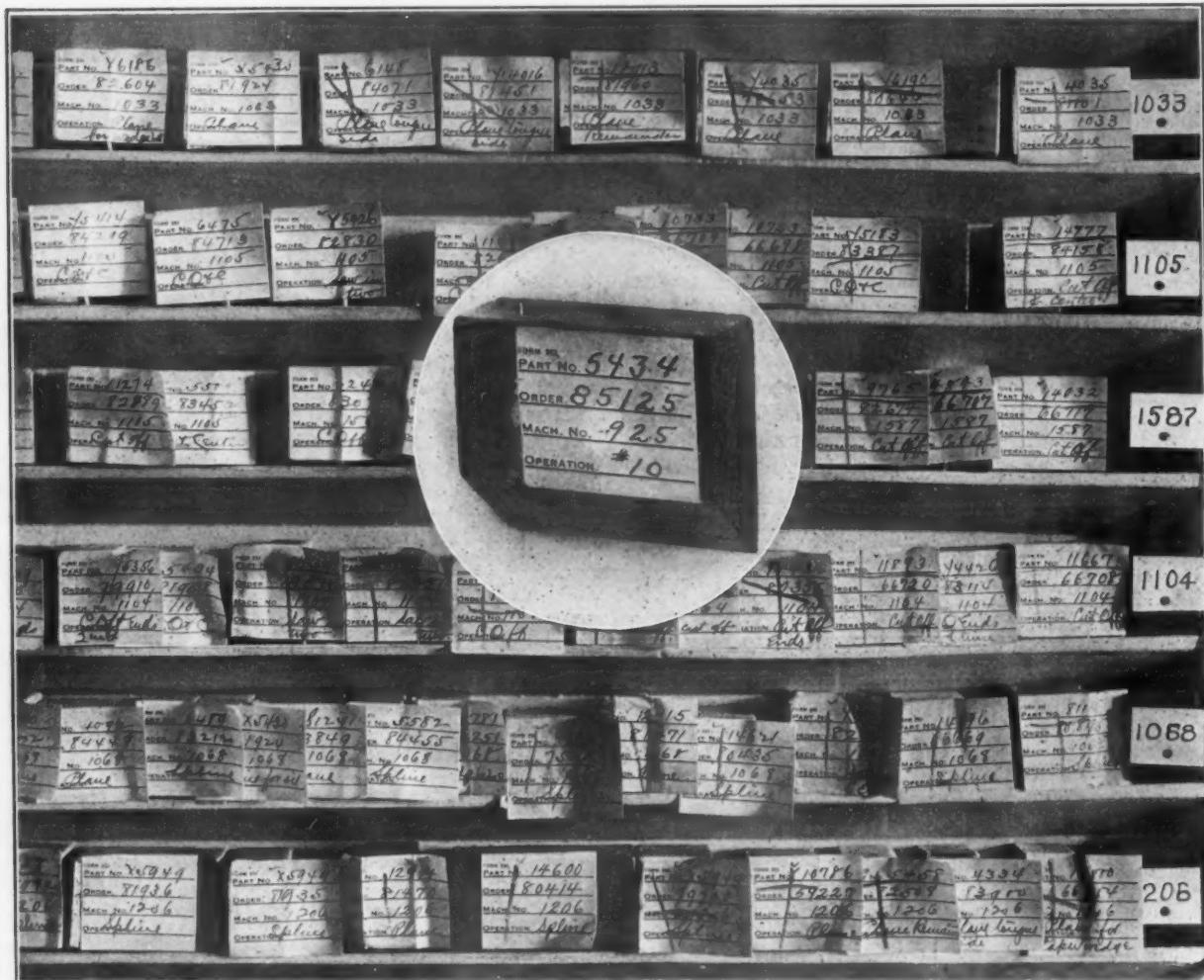
Each shelf on these dispatch boards represents a single machine, its number appearing on a black wooden block at the end of the shelf. Each job ahead for a machine is shown by a wooden block placed on the proper shelf.

and are clipped together. They serve as a guide to the inspectors, the workmen and the foremen.

When an operation is completed the routing sheet is detached by the inspector and sent to the cost department as a further check on completed operations. Use is made of the routing sheet, as shown, to describe operations, or to bring out any particular points in connection with them, or to illustrate, by means of drawings, roughing operations. This takes from the operator the necessity for doing any mathematical work, and also obtains the same roughing dimensions in each succeeding lot of pieces. It is beneficial in several ways, not the least of which is elimination of quarreling over piece-work prices on account of the amount of stock that may be left for finish. The information conveyed to the oper-

ready for the shop to use. If the material has not arrived the stock clerk holds the envelope until he can obtain the material. The envelope is given to the dispatcher on the arrival of the material.

This department uses blocks of wood in the form shown in the illustrations to represent each operation shown by the time card in the envelope. The length of time required for an operation for the lot is shown by the length of the block, the blocks being made to the scale that 1/10 in. is equal to one hour of time. To these blocks are fastened stickers which give the part number, the shop order number, the name of the operation, and the machine best adapted for this operation. When the blocks for a given order have been filled out they are placed on the shelves, one of which represents a definite ma-



This close view shows a section of a dispatch board. The black block at the right bears the machine number. Each wooden blue block bears a job ticket. The blocks are made on a scale of 1/10 in. of length, representing one hour of time. A vertical blue line on the ticket shows that the previous operation is completed; a horizontal line that the time card for the job has been passed to the foreman.

ator on the routing sheets is such as to do away with the necessity for him to do any calculating of dimensions and limits or any extensive thinking. This is one of the developments due to the fact that most large machine shops now have a large force of machine operators but few machinists in the sense conveyed by the word machinist twenty years ago.

A time card is made out to agree with each of the routing sheets. These are complete in every detail except for the clock number of the operator. This means that the amount of clerical work actually done by shop men is reduced to the least possible amount.

The envelope is now ready for the stock clerk, who, having authorized the shop order, has already ordered his material. If the material has arrived, he so indicates on the envelope, and the envelope is

chine in the shop. The envelope with its blueprint and routings is then filed, ready for shop use.

The general foreman, who has charge of production, starts the shop order into the factory in time to meet his needs on the assembly floor. He does this by ordering that the first operation on this job shall be given to that machine best adapted for that first operation. It is the duty of the general foreman to maintain ahead of each machine in the plant three operations, so that the workmen will at no time be out of work, and so that the foreman will not have to hunt for jobs for his men.

As soon as an operation is completed, the time card, which has just been rung out on that operation, is sent to the dispatcher. The dispatcher takes down from the machine shelf the corresponding block of wood. It is then his duty to call to the

attention of the general foreman the fact that a new operation should be found for this machine, in order that the machine may still have three operations ahead of it. In order that the general foreman may know what operations listed against the machine are available, when an operation is finished, the dispatcher marks the next succeeding operation with a vertical blue line, which tells the general foreman that this operation is available for the given machine. He can therefore select any such available operation to be the third operation demanded from that machine. When the vertical line is crossed by a horizontal line, it indicates that the foreman has received the time card.

As soon as an operation is selected as the third operation demanded from the machine, the dispatcher sends to the foreman having charge of that

The middle and the left of this group of illustrations are the two faces of a card punched by an inspector after an operation is finished. It is turned in to the time clerk by the operator and used to calculate piece wages. The fifth line on the reverse side enables the operator to assign payment to some other person. The punches show the truck number, number of pieces, piece price and date.

TRUCK NO.	
1.	LAYOUT & HEAD
2.	ROUGH GRIND BEARING
3.	ROUGH TURN FLANGE
4.	ROUGH TURN END
5.	R. TURN FLANGE BEARING
6.	CUT OFF & CENTER
7.	Straighten # 1
8.	Grind for blocks
9.	POLY for blocks
10.	ROUND GRIND PINS
11.	FINISH GRIND PINS
12.	CUT OFF BLOCKS
13.	FINISH TURN END
14.	SQUARE NECK & CHAMFER
15.	Straighten # 2
16.	FINISH GRIND BEARINGS
17.	PIN GRIND FLANGE END
18.	FINISH GRIND SHORT END
19.	FINISH TURN FLANGE
20.	DRILL & KEYSEAT
21.	DRILL & REAM FLANGE
22.	Straighten # 3
23.	
24.	
25.	
26.	
27.	
28.	
29.	
30.	
31.	
32.	
33.	
34.	
35.	
36.	
37.	
38.	
39.	
40.	
41.	
42.	
43.	
44.	
45.	
46.	
47.	
48.	
49.	
50.	
51.	
52.	
53.	
54.	
55.	
56.	
57.	
58.	
59.	
60.	
61.	
62.	
63.	
64.	
65.	
66.	
67.	
68.	
69.	
70.	
71.	
72.	
73.	
74.	
75.	
76.	
77.	
78.	
79.	
80.	
81.	
82.	
83.	
84.	
85.	
86.	
87.	
88.	
89.	
90.	
91.	
92.	
93.	
94.	
95.	
96.	
97.	
98.	
99.	
100.	
101.	
102.	
103.	
104.	
105.	
106.	
107.	
108.	
109.	
110.	
111.	
112.	
113.	
114.	
115.	
116.	
117.	
118.	
119.	
120.	
121.	
122.	
123.	
124.	
125.	
126.	
127.	
128.	
129.	
130.	
131.	
132.	
133.	
134.	
135.	
136.	
137.	
138.	
139.	
140.	
141.	
142.	
143.	
144.	
145.	
146.	
147.	
148.	
149.	
150.	
151.	
152.	
153.	
154.	
155.	
156.	
157.	
158.	
159.	
160.	
161.	
162.	
163.	
164.	
165.	
166.	
167.	
168.	
169.	
170.	
171.	
172.	
173.	
174.	
175.	
176.	
177.	
178.	
179.	
180.	
181.	
182.	
183.	
184.	
185.	
186.	
187.	
188.	
189.	
190.	
191.	
192.	
193.	
194.	
195.	
196.	
197.	
198.	
199.	
200.	
201.	
202.	
203.	
204.	
205.	
206.	
207.	
208.	
209.	
210.	
211.	
212.	
213.	
214.	
215.	
216.	
217.	
218.	
219.	
220.	
221.	
222.	
223.	
224.	
225.	
226.	
227.	
228.	
229.	
230.	
231.	
232.	
233.	
234.	
235.	
236.	
237.	
238.	
239.	
240.	
241.	
242.	
243.	
244.	
245.	
246.	
247.	
248.	
249.	
250.	
251.	
252.	
253.	
254.	
255.	
256.	
257.	
258.	
259.	
260.	
261.	
262.	
263.	
264.	
265.	
266.	
267.	
268.	
269.	
270.	
271.	
272.	
273.	
274.	
275.	
276.	
277.	
278.	
279.	
280.	
281.	
282.	
283.	
284.	
285.	
286.	
287.	
288.	
289.	
290.	
291.	
292.	
293.	
294.	
295.	
296.	
297.	
298.	
299.	
300.	
301.	
302.	
303.	
304.	
305.	
306.	
307.	
308.	
309.	
310.	
311.	
312.	
313.	
314.	
315.	
316.	
317.	
318.	
319.	
320.	
321.	
322.	
323.	
324.	
325.	
326.	
327.	
328.	
329.	
330.	
331.	
332.	
333.	
334.	
335.	
336.	
337.	
338.	
339.	
340.	
341.	
342.	
343.	
344.	
345.	
346.	
347.	
348.	
349.	
350.	
351.	
352.	
353.	
354.	
355.	
356.	
357.	
358.	
359.	
360.	
361.	
362.	
363.	
364.	
365.	
366.	
367.	
368.	
369.	
370.	
371.	
372.	
373.	
374.	
375.	
376.	
377.	
378.	
379.	
380.	
381.	
382.	
383.	
384.	
385.	
386.	
387.	
388.	
389.	
390.	
391.	
392.	
393.	
394.	
395.	
396.	
397.	
398.	
399.	
400.	
401.	
402.	
403.	
404.	
405.	
406.	
407.	
408.	
409.	
410.	
411.	
412.	
413.	
414.	
415.	
416.	
417.	
418.	
419.	
420.	
421.	
422.	
423.	
424.	
425.	
426.	
427.	
428.	
429.	
430.	
431.	
432.	
433.	
434.	
435.	
436.	
437.	
438.	
439.	
440.	
441.	
442.	
443.	
444.	
445.	
446.	
447.	
448.	
449.	
450.	
451.	
452.	
453.	
454.	
455.	
456.	
457.	
458.	
459.	
460.	
461.	
462.	
463.	
464.	
465.	
466.	
467.	
468.	
469.	
470.	
471.	
472.	
473.	
474.	
475.	
476.	
477.	
478.	
479.	
480.	
481.	
482.	
483.	
484.	
485.	
486.	
487.	
488.	
489.	
490.	
491.	
492.	
493.	
494.	
495.	
496.	
497.	
498.	
499.	
500.	
501.	
502.	
503.	
504.	
505.	
506.	
507.	
508.	
509.	
510.	
511.	
512.	
513.	
514.	
515.	
516.	
517.	
518.	
519.	
520.	
521.	
522.	
523.	
524.	
525.	
526.	
527.	
528.	
529.	
530.	
531.	
532.	
533.	
534.	
535.	
536.	
537.	
538.	
539.	
540.	
541.	
542.	
543.	
544.	
545.	
546.	
547.	
548.	
549.	
550.	
551.	
552.	
553.	
554.	
555.	
556.	
557.	
558.	
559.	
560.	
561.	
562.	
563.	
564.	
565.	
566.	
567.	
568.	
569.	
570.	
571.	
572.	
573.	
574.	
575.	
576.	
577.	
578.	
579.	
580.	
581.	
582.	
583.	
584.	
585.	
586.	
587.	
588.	
589.	
590.	
591.	
592.	
593.	
594.	
595.	
596.	
597.	
598.	
599.	
600.	
601.	
602.	
603.	
604.	
605.	
606.	
607.	
608.	
609.	
610.	
611.	
612.	
613.	
614.	
615.	
616.	
617.	
618.	
619.	
620.	
621.	
622.	
623.	
624.	
625.	
626.	
627.	
628.	
629.	
630.	
631.	
632.	
633.	
634.	
635.	
636.</td	

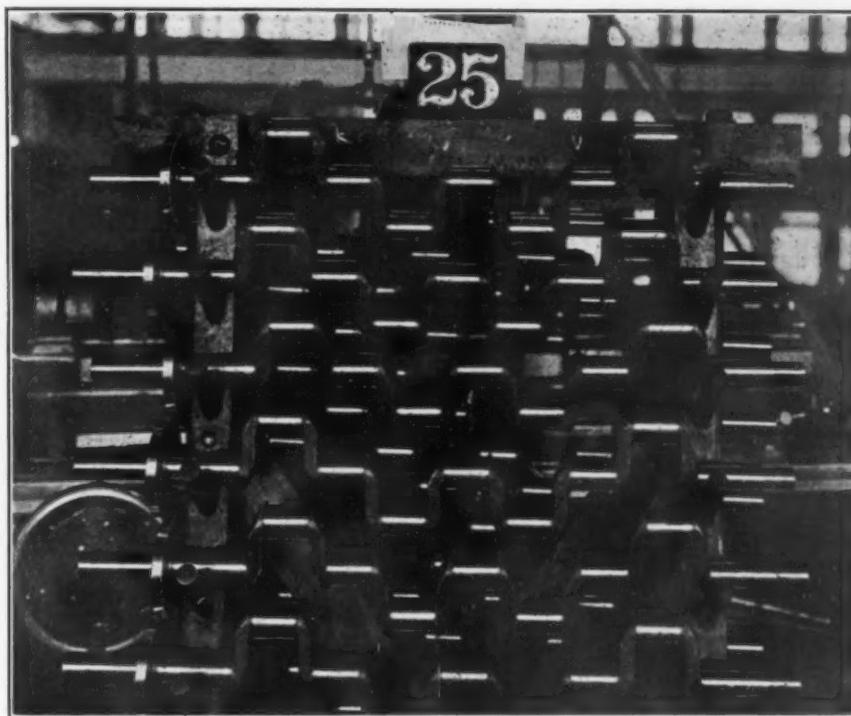
has specialized in the contract grinding of automobile parts, particularly crankshafts. It has recently devised an accounting method for its piece-work operators on this class of work which eliminates much of the bookkeeping, both for the operator and for the cost department.

Twenty crankshafts are mounted on a special truck and go through as one job. The truck bears a tag which is punched by the inspector as each operation on the crankshafts is finished. This tag stays with the truck through all the operations. There is a somewhat similar tag which the operator turns in and which is used in figuring up his time or piece-work wages in computing his pay for the week. At the top of this particular tag are two parallel series of figures from 1 to 0. The truck number is punched out on these numbers, as shown

after the lines of the transfer used by most of the street railway companies. This is one of the ways in which shop practices of the Norton Grinding Company have moved away from the beaten path followed by most manufacturing machine shops.

A distinctive method is used to mark the raw steel stock. The steel stock has been standardized to nine kinds which are designated by numbers, as in the following list:

- No. 1. C. R. S. screw stock.
- No. 2. 15 to 20 P. C. O. H. M. S.
- No. 3. 30 to 40 P. C. O. H. M. S.
- No. 4. Crucible steel O. H.
- No. 5. Center steel.
- No. 6. 100 to 110 P. C. tool steel.
- No. 7. 15 to 20 P. C. alloy steel.
- No. 8. 30 to 40 P. C. alloy steel.
- No. 9. Alloy steel over 40 P. C. and high in nickel or vanadium, such as used for spindles.



by the illustration. Down the left-hand side of the tag is a column of numbers from 1 to 20 which is punched to show the number of crankshafts on that truck. The center is printed with a description of each operation. On the right-hand side is a column giving the piece-work prices for each operation beside which is room for a punch hole which is made by the inspector when the operator finishes the job. At the bottom of the tag the months and the days of the month are printed and are punched out to show the date of the operation.

On the back of this tag, as shown, is some information regarding the order number, kind of crankshaft, number of pieces accepted and rejected, rate, amount of night bonus, and the total. This bears instructions filled in by the inspector giving the name of the employee and the stock number. There is an extra line so that the operator can assign the payment of his check to some other person who can draw his pay from the paymaster. Whoever draws the pay, whether the operator or the assignee, gives a receipt for the payment on the bottom line. This forms an extremely simple way of keeping track of piece-work and is of real service to the paymaster in making up the payrolls. The idea is borrowed from the practice in the shoe industry, but the tag in this case is modified somewhat

A letter of the alphabet designates each concern from which steel is bought. The instructions read: Mark steel number first, then firm letter. Thus, center steel from Bethlehem Steel Company would be marked 5-G.

As the various producers and dealers differ in the end color marking for the same stock, the confusion that would thereby be caused is eliminated by the special code numbers and letters stamped upon the exposed end of each bar when it is placed in the rack. All portions cut from a bar are cut from the other end so that the last fragment still bears its distinguishing mark. The alphabetical marking makes it easy to tell from just which concern the steel was received.

To make sure that the low carbon machinery steel does not contain an excess of carbon, an easy and certain method of analysis is employed. A disk, $\frac{1}{2}$ in. thick, is cut from each bar and carbonized along with any of the regular jobs. One-eighth inch is next cut off one side of the disk. If the stock did not contain more than 20 points of carbon, the carbonized portion of this side should be removed by this operation. The disk is then sent to the hardening department and heated and quenched. One side should then be glass hard and the other side be easy to machine. This is determined by a drill test.

Keeping Track of Work in Process*

A Combined Production-Operation Order
Cost Record Serves to Locate Every
Part of Every Order at Any Time

BY H. A. RUSSELL

THE method followed in getting work through the factory can be best understood by following a particular lot of castings from the foundry to the machine shop and thence onward, operation by operation, until they are finished and either become a part of the complete machine or are placed in storage. The casting that has been selected weighs 64 lb. Castings of this weight, either in the rough or finished state, are piled one on top of the other. Smaller castings are placed in bins on which the designating letters and numbers have been stenciled. Each bin section, containing from twenty to sixty bins, has a number.

quired for each complete machine is also given. When the quantity of pieces on hand is reduced to the minimum designated on the card as the "low limit" the clerk in charge of the record notifies the production chief by means of a written memorandum. The item "desirable order" quantity is subject to such change as may appear necessary. The principal reason for this item is to bring to the attention of the production chief the most desirable quantity of each casting to start through the factory. If, however, there is an unusual run on any one size of machine he uses his judgment as to the quantity to be ordered, as was done in the case under review. Here the full 210 pieces needed were ordered, possibly to give the foundry a good start or to meet a shortage of work for certain machines in the engine department.

In the columns headed "operation" the sequence of machine operations is given. The piece-work price and the department number in which each operation will be performed is filled in as shown. A part may be partly finished in one department and then proceed to another for completion. The production operation order is ruled and printed on both sides, giving space for the recording of eight separate operations. If more than eight operations are required for finishing any one part a second card must be used. When this is done the cards are plainly marked Card No. 1, Card No. 2, etc.

The piece-work prices given in the illustrations are fictitious and other items have been changed, but the method of recording the items is identical with the method now in force.

The first quantity recorded on the card is the 40 pieces reported in the inventory. See entry on top line in "rough" column. On Jan. 5 the production department sent the molder's work card to the foundry, ordering 210 pieces to be made, a notation to this effect first being made in the first two columns of the production-operation order. On Jan. 8 the goods-received report indicated that 40 rough castings A164 had arrived in the engine department, making a total of 80 pieces on hand. On Jan. 10, 40 more pieces were received, making a total of 120 pieces, but as on the same day 30 pieces were delivered to the operator for slotting, the total of rough pieces was reduced to 90.

KEEPING THE MEN'S TIME

The production-operation order showed the slotting operation had been completed on 29 pieces on Jan. 10. This record was taken from the operation time card, Fig. 1. The operation time card is 4 x 6 in. and of medium weight paper. Day work cards are white and piece-work cards green. When the operation is performed under an hourly wage, instead of a piece rate the entries are made in the same manner, excepting that the hourly wage is filled in the "rate" column. The difference in the color automatically warns the party making the entry. From these cards the pay roll is made up, each card being O.K'd by the assistant foreman in the department.

At the completion of each job the operator makes a cross-mark over the nearest tenth of an hour to

OPERATION TIME CARD															
Pattern or Part No.		Oper. No.		Dept.											
A164		Drill & Tap		Man's No. 147											
Part Name		Balance Disc		Date											
Classification				1/16											
Order No.		Man's Name		Class											
		G. A. Snyder													
Pieces Finished Good		50		Spoiled		Defective									
M	T	W	Th	F	S	Morning		M	T	W	Th	F	S	Afternoon	
X	7.06	7.12	7.18	7.24	7.30	7.36	7.42	7.48	7.54	7.60	7.66	7.72	7.78	7.84	7.90
B	8.06	8.12	8.18	8.24	8.30	8.36	8.42	8.48	8.54	8.60	8.66	8.72	8.78	8.84	8.90
C	9.06	9.12	9.18	9.24	9.30	9.36	9.42	9.48	9.54	9.60	9.66	9.72	9.78	9.84	9.90
D	10.06	10.12	10.18	10.24	10.30	10.36	10.42	10.48	10.54	10.60	10.66	10.72	10.78	10.84	10.90
E	11.06	11.12	11.18	11.24	11.30	11.36	11.42	11.48	11.54	11.60	11.66	11.72	11.78	11.84	11.90
F	12.06	12.12	12.18	12.24	12.30	12.36	12.42	12.48	12.54	12.60	12.66	12.72	12.78	12.84	12.90
G															
H															
I															
J															
K															
L															
M															
N															
O															
P															
Q															
R															
S															
T															
U															
V															
W															
X															
Y															
Z															
TOTAL TIME		RATE		O. K.				Sole				Foreman			
Hours	Minutes	5¢	8.25¢												
8	2														

Fig. 1—The operator crosses out the time division on the card most nearly corresponding to the actual time of starting work, and he similarly marks the time when he finishes. The elapsed time, rate and earnings are computed in the office

painted in large figures on each end of the section. Each row is designated by a letter starting with A for each section. These letters are also painted on each end of the row. On the front of each bin is another number which is one of a series starting with 1 and running up as high as necessary. Therefore, if the record should designate "Section 2-Row B-Bin 5," it is an easy matter to find the proper castings.

THE PRODUCTION-OPERATION RECORD COST CARD

The piece which will be followed through the factory is the crankshaft balance disk of an Ajax $7\frac{1}{2}$ x 10-in. engine. The symbol of this part is A164. The yearly inventory on Jan. 1, 1916, indicated that 40 pieces of A164 were on hand in the rough state. The production department, having analyzed the estimated sales, found that it should order 210 pieces of A164 from the foundry to complete 250 engines which had been specified. The first step is to fill in the production-operation cost card, Fig. 2, with the symbol number and name of the part, the name and size of a machine on which the casting is used, the minimum quantity to be carried in stock, the size of the desirable order, the weight per piece and the location in the storeroom. When the casting or other part is used on several different sizes of machine all of the sizes are specified. The number of castings re-

*Second of a series of three articles describing the production methods of a large agricultural implement factory. The first appeared in THE IRON AGE, June 29.

Fig. 2.—The production-operation cost record gives complete information regarding the progress of each part through the factory from the time it is ordered until it is incorporated in the finished machine. It not only shows what work has been completed but what work is ahead of each department.

the actual minute of finishing the last casting. The time record can never be more than 3 min. away from the actual facts. The starting time had been indicated in the same manner and the actual time consumed is easily determined. The total time, rate and amount earned is filled in when the cards reach the office. Each day all of the cards for the previous day's work are collected, and as fast as the calculations are made the entries are recorded on the proper production-operation cost record card. The progress of the various operations and the movement of the work from department to department is clearly shown in Fig. 2.

FOLLOWING THE ORDER THROUGH THE SHOP

The total number of castings slotted at the end of Jan. 12, was 59 pieces. On Jan. 13, 50 pieces were sent to be drilled and tapped. On Jan. 14, these 50 pieces moved to the third operation, "bolting on shaft." On Jan. 16, 12 pieces passed to the final operation, "turning." As one casting proved to be defective while being machined, only 11 good castings remained, but as the operator had practically finished machining the defective casting before the defect became apparent, he was given credit for 12 pieces. Under "slotting" three separate castings are noted in the "bad" column. The operator was not paid for these, as the defects were discovered before any work was done on the castings. In order to keep the record straight all castings or other parts are reported, no matter whether they are good, bad, broken or spoiled in any way.

On the extreme right-hand side of the production-operation order card is an additional set of columns, headed respectively "total good," "moved," "balance." These columns are used for the purpose of checking off the finished parts as they become a part of the completed machine, or when they are sold as repair parts. When there are more than four operations on a part the two sets of columns on the reverse side of the card are used. Two columns are necessary for this purpose, because castings and other parts are generally machined in lots which are greater than the daily requirements of completed machines. Therefore it was necessary to provide for the greater number of entries which would go into these columns.

The production-operation cost record, Fig. 2, shows that on Jan. 22 (the date of the last entry) that there were on hand 134 rough castings, 13 castings slotted only, 78 castings bolted to the shafts and 7 castings ready to become a part of the complete engine. If the foreman of the engine department wishes to know the condition of the stock of parts for any size of engine the information can be secured from this record. He also can learn what work is ahead for each machine. Two entry clerks can handle several thousand items per day. The reports from the shop must come in accurately however, but this is principally a matter of training.

LOW LIMITS AND DESIRABLE ORDER QUANTITIES

The inventory on Jan. 1 indicated that only 40 pieces of A164 castings were on hand, while the low limit had been fixed at 50 pieces. At the end of the year quantities are allowed to fall below the low limits, as it makes the inventory an easier matter, and as there are usually a number of corrections to be made in the cards. A casting will disappear and another one will be found of which there is no record. These discrepancies generally result from reporting the incorrect number or letter and are bound to happen at times, no matter how much care is taken. So while the low limits

and desirable order quantities have been fixed through consultations between the production chief and the foremen of the respective departments, there is no hard and fast rule regarding them. Circumstances are allowed to alter the case as may seem expedient. The production department chief must be allowed to use his best judgment, and in order to do so he must keep in daily touch with the output of each department in the factory, speeding up one department so as to avoid delaying another. Should there be any danger of a department being held up by the non-receipt of material, the production chief must have other work planned. If there is a break in the output of one line another can be substituted without delay, thus preventing the loss of output by that department.

PRODUCTION DEPARTMENT INSTRUCTIONS

When the production department was organized certain instructions were issued, in the form of typewritten memoranda. While these were necessarily somewhat voluminous, they were planned to be permanent and to be in such complete form that a new man in the department, after reading the instructions, would have a thorough understanding of the duties and responsibilities of it. The duties and functions of this department are divided as follows:

- Division 1. Records and record-keeping.
- Division 2. Reports to production department.
- Division 3. Low limits and desirable order quantities.
- Division 4. Production orders and erecting orders.
- Division 5. Relations with purchase department.
- Division 6. Reports by production department.
- Division 7. Follow-ups and promises.

The first division relates to records and the manner of keeping them. Among these are the production-operation cost record cards covering such items as gray-iron and malleable castings, brass castings, steel castings, steel parts, crankshafts, etc. Another set of records covers all shipments of engines, sawmills, threshing machines, etc. A third set refers to the production orders that have been issued for complete machines and also the total yearly sales of each style and size of machine. Still another set refers to all patterns that have been made in the pattern department or have been sent to the factory by customers.

Division 2 covers all the reports which should come to the production department to enable the records to be kept accurately. The responsibility of securing these reports at the required intervals rests on the production department.

Division 3 relating to low limits and desirable-order quantities is especially interesting. To quote from the memorandum covering this division:

Theoretically, the low limit of machines of any type (product) would be just enough of them finished on hand to last until an entirely new production-order could be issued, the castings made and finished, purchased material ordered, received, forged, finished and the complete set of new machines erected. This would therefore be the low limit of each piece in such machine.

But it is impossible to provide room for storage of so much finished product.

Consequently the aim is to carry on hand the fewest possible finished machines consistent with being able to fill customers' orders.

From this it follows that there are necessarily different low limits for finished product and for pieces composing the finished product.

Therefore we fix the low limits as follows:

First: The low limit of any particular finished machine

is the fewest number of machines that will answer the requirements of our trade.

Second: The low limit of any piece in a machine must be sufficiently large to allow ample time (after it is just passed) for a new requisition to be issued for the piece, to make it, or purchase and receive it, to finish it and erect it in new finished machines. This involves many considerations, which may be grouped as follows:

Group 1. Castings from the foundry. Consider the number of days required to mold the desirable quantity—depending upon whether bench or floor work, whether cores must first be made, quantity of flasks on hand of a suitable size, size of castings, percentage of loss, time required to finish in machine department, etc.

Group 2. Purchased articles on which we do work. Consider whether worked on in finishing department only or in several departments, such as connecting rods, which are forged in the blacksmith shop and then go to the machine shop to be finished. Ordinarily standard sizes of bar steel can be secured in from four to six weeks, but large rounds and squares, malleables, steel castings, odd sizes of flat steel, special shapes, etc., may take two or three times as long.

Group 3. Purchased articles upon which we do no work.

A. Where regular—can be obtained in from one to three weeks, depending upon kind and circumstances (such as valves, pipe fittings, etc.).

B. Where special—(such as special safety valves or special traction throttle valves, etc.) will take from three to seven weeks or more. Low limits vary accordingly.

The desirable quantity to machine at one time varies, to some extent, upon the cost of setting up the various machines. Certain operations may require several hours to get ready before any actual productive work can be started, in other instances a few minutes may be sufficient. In the blacksmith shop it may mean the changing of heavy dies and to hammer only a few pieces would be an expensive operation per piece. Another element to be given consideration is the amount of material on hand of the proper size and quality. Still another factor is the length of time needed to finish a given number of pieces. If a lathe or planing machine or hammer is tied up too long on one part of the product it may throw some other line of product too far behind.

Division 4 contains the instructions for issuing production and erecting orders. The production order goes direct to the foreman of the department and indicates the actual quantity of each part that is to be made. The erecting order contains instructions as to the quantity of each size and style that is to be assembled complete, ready for shipment. As the production department controls the supply of parts, it is always in a position to issue the erecting orders correctly. The production order was illustrated previously.* It is a loose-leaf binder sheet, 8½ x 11 in., with the words "production order" printed at the top. The body of the sheet is ruled with horizontal lines. No attempt is made to provide for each item separately, on account of the variety of parts manufactured. Before issuing a production or erecting order the following facts are considered: Stock on hand; parts and finished machines; warehouse or storage capacity; season of the year.

Division 5 covers the relations that must exist between the production and purchase departments. Frequent consultations must be the rule. With the right spirit of co-operation between the two departments costs are lowered, production increased, and a good example of thoroughness is set for the other departments in the office, as well as in the factory. When the two departments cannot, or will not, work in harmony, there is something wrong and the sooner the matter is given the proper attention the better for all concerned. The instructions covering Division 5 are complete and specify clearly what the duties of the production department are, as affecting its relationship with the purchase de-

*THE IRON AGE of June 29, page 1557.

partment. Certain items are ordered by the purchase department on its own responsibility, but a copy of the purchase order goes to the production department, minus prices and terms, but including a notation as to the time the material may be expected.

Division 6 refers to the reports which the production department must make to the management, also to the other departments. These reports cover such items as the monthly inventory of finished machines on hand, the yearly report of machines built and a somewhat similar report which shows the number of machines and implements actually shipped, arranged so that there is a means of making a quick comparison with the previous year's shipments. To the sales department a weekly report is made covering the machines on hand ready to ship. This last report is filled in on a printed form (by the sales department) and copies are mailed weekly to the dealers.

The method of following orders through the factory is outlined in Division 7. In this division the attention of the production chief is called to the fact that the real function of his department is to speed up the various departments, so that maximum results will be obtained at a minimum cost. Consultations are held daily or oftener with the foremen of each department in the factory. The production department is also in telephonic connection with each factory and office department.

ADVANTAGES OF THE PRODUCTION-OPERATION ORDER

The forms illustrated have proven their adaptability to the system and give records which are dependable. The production-operation cost card furnishes information which permits of the following results: The shop departments can more readily and easily plan their work. The production department can more easily and intelligently issue production orders and follow them up. The sales department will receive promises which can be depended upon regarding the shipment of customers' orders. The cost department will have easy access to correct costs. The time department will have a check on earnings and piece-work counts.

All of these results depend, however, upon the accuracy of each individual daily time slip. As these same time slips are the ones from which the pay-roll is made up, the question of accuracy is a fundamental one and no greater amount of work is entailed than that which is necessary for the purpose of the time department. In planning the production-operation cost card the first consideration was to avoid duplication of work, and the results obtained do not require a single item of information in excess of what would be in any event turned in daily.

Tennessee Company Improvements

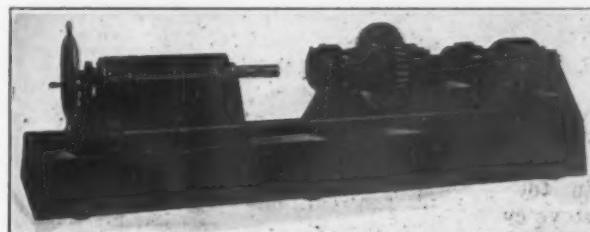
BIRMINGHAM, ALA., July 3, 1916.—(By Telegraph).—The Tennessee Coal, Iron & Railroad Company announces plans for several improvements. One is the installation of an electric furnace at Ensley for pre-heating ferromanganese and another is the doubling of the blowing capacity for the Bessemer end of the duplexing plant at Ensley by the installation of a spare engine. Further items on the program are the building of employees' bathhouses and school buildings at a number of the company's operations.

Forty-seven large manufacturing concerns at Oshkosh, Wis., on July 1 put into effect the "extra daylight" plan by permitting all employees to start and finish work an hour earlier.

A Heavy Boring Lathe for 6-In. Shells

An unusually heavy projectile boring lathe designed especially for high-speed work on 6-in. shells has been put on the market by the Osborne & Sexton Machinery Company, Columbus, Ohio.

The bed, which is of heavy deep pattern with double-webbed box type girts to prevent vibration and springing, has a total length of 12 ft. 6 in. The lathe has a 40-in. swing and is geared at a ratio of 8 to 1. A 4½-in. hole with a depth of 12¾ in. can be bored in a 6-in. solid billet in 25 min., while on drawn shell work this operation can be performed in approximately 5 min. The length between the faceplate gear and tailstock spindle is 48 in., so that the machine can bore a hole 21 in. in depth. The two sets of driving gears are cut from the solid and have heavy guards.



A Heavy Lathe for Boring 6-In. Shells Capable of High-Speed Work

The spindle bearings are 6 x 10 in. The diameter of the pinion and pulley shaft is 2 15/16 in. The driving pulley has a 10-in. face and is 16 in. in diameter, and the diameter of the faceplate gear is 26 in.

The headstock is 36 x 55½ in. and is provided with lugs for the motor brackets. The tailstock base is provided with tongues to fit in the groove in the top piece to permit of lateral adjustment by the screws shown and thus take the thrust of the cutter bar. The tailstock spindle is of high-carbon steel and ground to fit in the tailstock and the cutter bar end of the spindle has a No. 6 Morse taper hole with a slot across the end of the spindle for a driving key. This key is made small enough so that it will shear off, should the cutter become fouled and thus prevent damage to the bar. The variable feed to the tailstock spindle is through a lay shaft at the back of the machine, which is operated by a rocker arm on the shaft and a crankpin on the end of the main spindle, the two being connected by a connecting rod. On the tail end is a rocker arm which is connected with a second rocker arm on the screw by a connecting rod, and the rocker arm on the screw has a pawl engaging a ratchet wheel keyed to the screw.

The total shipping weight is 16,000 lb. and the manufacturer recommends that not less than 15 hp. be provided for heavy work.

The French Army Helmets

The French army steel helmets are stamped out of the best half-hardened sheet steel, about 1 mm. thick, according to the *Bulletin des Armées*, a government publication. Four pieces make up the helmet: The cap, the peak, the neck protector, and the crest, and they are riveted together and sprayed with a gray-blue paint just enough to prevent rust. After drying for three hours at 135 deg. C., the helmet is lined and fitted with the chin strap. Each one requires about 2 lbs. of steel and a little aluminum to stiffen the lining. Over 3,500,000 have already been made, and 50,000 per day are turned out, three-quarters of the work being done by women.

The Wight Electric Recorder Company, Cleveland, will place on the market an electric time recorder for water in steam boilers. It is the invention of James Wight, formerly master mechanic in the employ of the Otis Steel Company, Cleveland. The machines, for the present, will be manufactured by the Fanner Mfg. Company, Cleveland. The Wight Company has been incorporated with a capital stock of \$30,000.

A Motor-Driven Seam-Welding Machine

A new type of motor-driven seam-welding machine has recently been put on the market by the Toledo Electric Welder Company, Cincinnati, Ohio. These machines are especially adapted for welding the side seams of coffee pots, pails, phonograph horns and other articles made from clean, pickled sheet steel of light gages. It is stated that the edges of the stock overlap only from $1/32$ to $1/8$ in., and that the pressure of the rolls forces the stock together so that it is only from 0.002 to 0.003 in. thicker at the joint than it is outside the welded area, so that when the articles are enameled or japanned it is almost impossible to detect the place where the weld was made.

The machine is also used in the manufacture of oil-stove cylinders that are $3\frac{1}{4}$ x $4\frac{1}{2}$ in. of No. 24 lead-coated stock, where the weld, of course, must be absolutely tight and with a smooth finish. It is claimed that 5000 of the cylinders can be welded on the machine in 9 hr. The rolls pass from the cylinder at the rate of 18 ft. per minute, and only a fraction of a second is required to weld a $4\frac{1}{2}$ -in. seam. Two men operate the machine and two jigs are used. One operator places the stock in the jig and passes it to the man doing the welding, and while this operation is being done the second jig is filled as quickly as the first piece can be welded. The jig holding the cylinders is placed over the lower stationary horn of the welder that serves as one electrode. A slight pressure on the foot treadle shown trips a clutch that sets a worm drive in motion and thus carries the upper copper roll over the overlapping edges of the stock to be welded. The roll passes from the cylinder in $1\frac{1}{2}$ sec. and the current is automatically turned on at the instant that the copper roll touches the cylinder, and it is turned off immediately when the roll reaches the outer edge of the cylinder. At the same time the worm drive is reversed and the roll is returned to its original position ready for the next weld. The roll is water-cooled to prevent overheating.

An alternating current of either 25 or 60 cycles can only be used at either 220 or 440 volts. A special transformer located inside the machine reduces the current to about 3 to 5 volts, so that there is no danger of the operator receiving a shock. Based on a current cost of 1c. per kilowatt hour, it is stated that the expense would be only 10c. per 1000 ft. of welded surface.

To take care of varying thicknesses of stock, a regulator is furnished to give different degrees of heat at the weld and the pressure of the rolls can be varied to suit the different stock used. The speed of work depends practically on the size and shape of the pieces handled and the rapidity with which the operator can pass them over the welding horn.

The Taylor-Wharton Iron & Steel Company, High Bridge, N. J., has increased its capital stock from \$2,000,000 to \$4,000,000.



A Motor-Driven Machine for Electrically Welding the Side Seams of Articles Made of Light-Gage Sheet Steel, Such as Coffee Pots, Pails, Phonograph Horns, Etc.

a dead cause. The following suggestions are given as to making the safety bulletin board most effective:

Brevity. Few men stop to read a wordy bulletin. Even at lunch time a long, printed bulletin must be of unusual interest to hold the attention of the workers.

News. Bulletins are effective in inverse proportion to the length of time they are posted. After they have been up for two weeks they are of doubtful value.

Statistics. Detailed statistics have not been universally demonstrated to be effective in use on safety bulletin boards. Not all workmen understand them. However, their results can be so charted as to be intelligible to most workmen.

Pictures. Pictures are most generally "read"—photographs especially. A picture is often used effectively to call attention to a short printed or typewritten statement.

Letters. Short letters or typewritten communications signed by some one in authority in the factory attract attention better than do printed statements.

Cartoons. Occasional cartoons or the use of subject matter other than safety varies the monotony but also detracts from the value of the board as a safety reminder if too much extraneous matter is introduced.

Simple Language. Bulletins must be in the language understood by the workmen. If they read Croatian put simple Croatian on the bulletin boards. If they read no printed language, post pictures instead.

Location of Boards. Have a definite place for posting bulletins, so situated as to reach the greatest number of men. If more than one bulletin board is accessible to the same group of men, put different subject matter on them.

Discontinuance. If all known means of keeping up interest in bulletin boards fail, leave the boards bare for a while. A bulletin which is not read is worse than none at all. Later the system may be renewed. Moving the board to another part of the plant will renew the interest of the workmen.

The Northwest Steel Company and Willamette Iron & Steel Works, Portland, Ore., have received a contract for the fifth steel steamer to be constructed by them, according to President Ball of the Willamette Works. The two plants now have work totaling \$5,000,000 contracted for, which it will take two years to complete.

The Zenith Furnace Company, Duluth, Minn., will add 15 coke ovens to its present plant. Both this and the Northwestern Iron Company's 36-oven plant at Mayville, Wis., which is to be doubled, are Solvay process plants.

A strong steel guard is erected outside the window to protect the sash and a cross bar serves as a point of support for the chute down which the bars and rods are slid to a skid



A WELL-PLANNED and well-conducted steel storage room and system is that of the Whitney Mfg. Company, Hartford, Conn., which makes roller chains, silent chains, Woodruff keys in large quantities, besides machinery and other products. The steel room itself is 56 x 164 ft. and a recent addition which is 56 x 80 ft. is used for the storage of steel in coils. The construction is of steel and brick with wood block floors. The space between one of the side walls and the end of the storage racks forms a broad aisle through both storage rooms.

At the inner end of the main aisle is an elevator with a capacity for hoisting a loaded 3-ton motor truck. A truck with supplies for the other portions of the plant is run upon this elevator and carried up to any desired floor. The elevator is stopped so that the body of the truck is level with the floor and goods are easily unloaded on hand or conveyor trucks.

A spur track runs along one side of the building its entire length. Cars containing steel bars and rods or wire are unloaded through any one of the windows, as shown in one of the illustrations. Outside of each of the windows is erected an iron framework to guard the window casings and a steel cross-bar on this serves as a support for a chute from the car to the inside of the building. Cars containing other materials than raw steel are set at the end of the spur track where there is a loading platform connecting through a large door with a removable platform at the foot of a large elevator previously described.

Special skids are used, upon which steel bars and rods are placed as they come down the chute from the cars. These are moved about by an elevating

conveyor truck. Unless market exigencies prevent, all the raw bar and rod stock is bought in 8-ft. lengths. As fast as a skid is filled it is hauled to the scales and weighed. The tare of each skid is marked on it, and the weight of the various conveyor trucks is also known. An empty skid is placed immediately beside the scales, which serves to hold surplus stock, as the net load on any one skid is made as nearly as possible 1 ton. This is for a purpose which will be explained.

The storage racks are made of steel and are divided into vertical sections. Such stock as is carried in large quantity is put into these sections and each ton lot is separated by wood cross-ties as is shown in the illustration of one of the stock aisles. If the average amount of stock is small the vertical sections are divided into two, four or other convenient divisions by steel cross-arms and that particular kind is put into the racks having subdivisions. All of the vertical sections and each sub-division of the racks have the size of stock in the section below painted upon the cross-bar. Some of the racks are roofed over with planks, furnishing extra storage space for materials not otherwise provided for. A small yellow slip bearing the number of the measuring card and the order number is inserted between the bars stored in each section. By this method the name of the shipper, the date of receipt and all other needed information is quickly made available. While extremely simple, this method of inserting the small slip of paper has been found to be very quick and reliable and serves to distinguish between different shipments of the same kind of stock.

Steel in coils is unloaded and handled in much the same manner as bar and rod stock. There is,

RECEIVED FROM:-		No.1000
VIA	ARRIVED	UNLOADED
ORDER No.	INVOICE	OUR WEIGHT

The Card Filled Out When Material is Received

manufacturing order, and three columns showing the weights received, the weights delivered to the departments and the weight on hand. This inventory sheet is also shown by illustration.

The routine of moving stock from the steel room to the job is as follows:

The department needing the stock sends a slip entitled "shop order wanted" to the planning department. This slip is on orange paper and has but little printing, the space being left largely to be filled in by the department head to meet his requirements. When this slip reaches the planning

RAW STOCK Size .1875" x .313" B/P L-2211					Key No. 9			
Ordered from Crucible Steel Co.		Grade Clipper	Months' Supply _____ tons					
ORDERED			BILLED		RECEIVED		BAL DUE	REMARKS
DATE	ORDER NO.	AMOUNT	DATE	AMOUNT	DATE	AMOUNT	BAL DUE	
Mar. 8/15	42,560	24,000	Mar. 29	7292	Apr. 3	7292		
			" 3	1480	" 6	1480		
			" 8	2303	" 9	2303		
			" 10	1542	" 13	1542		
			" 14	5774	" 16	5774		
			" 16	4460	" 23	4460		
			" 17	1750	" 23	1750	Filled	
May 24	43,627	30,000	Sept. 18	958	Sept. 25	958		
			" 22	2848	" 25	2848		
			" 26	2396	Oct. 1	2396		

The Form in Which Raw Material Records Are Kept

however, no effort made to get the same weight upon each skid. The skids each bear a card which conveys the same information as the yellow slip inserted in the bar stock and the net weight of the wire upon the particular skid.

Large use is made of special skids and elevating conveyor trucks. These trucks are used to carry stock to the cutting-off machines and for delivery to the different departments throughout the shop. The cutting-off department is located at one end of the storage room and has an adequate equipment for cutting all the varieties of stock carried, of which, owing to the nature of the business, there is a great diversity.

The office sends to the steel room a shipping notice which contains the information on the customer's invoice. When the stock comes in, a receiving card is made out for each shipment. This card gives details of the shipment, the routing by which the goods came, the date of arrival, the date of unloading, the order number, the weight, the kind of material as shown by the invoice and the actual weight as determined on the company's scales. The information on these receiving cards is put on a special form known as the raw stock card, which gives the size of material, the blue print, if it is special, the product for which it is to be used, the shipper's name, the grade of stock and the specifications for a month's supply. Columns upon the card show the date of order; the order number and the amount; the date and amount billed; the date and amount received; the balance due, and there is a column for special remarks. A specimen of this card is shown in one of the illustrations.

The date, order number and amount of each shipment is also kept on a special loose-leaf inventory sheet which has columns for the date of receipt of delivery to any department, the department or invoice number, the number of the steel order or

Form C-66		Flat Stock.		.055" x 15/16"	
RAW STOCK					
1015	DEPT OR INVOICE	ORDER NO.	RECEIVED	DELIVERED	ON HAND
8/2					4611
8/8	Dept 15A	4926		2146	
8/7	"	5042		143	
8/4		44189	4818		
8/3	"	1357		2627	
		370	44189	2300	
		384	44189	2930	
8/19	"	6361		2300	
8/24	"	6447		1680	
8/25		389		5785	
8/30	"	5453		2696	
9/1					8951
9/1	Dept 15A	6133		2120	
9/9	"	5961		2700	
		597	44159	4820	
9/13	" 15R	5690		2150	
9/16	"	5961		2190	
9/20	"	6040		2278	
9/24	"	6507		2324	
9/29	"	6566		2357	
9/27	428	44691	15245		
9/28	423		2357		
10/1					15254
O 10/4	"	44691	1818		
10/1	"	6823			1868
10/1	439	44691			
10/7	"	7618	678		
10/7		428	44691	11229	
10/12	"	7234			1923
10/18	"	6949			1940
10/19	"	6124			1990
10/20	"	6381			1958
10/27	"	7142			2346
10/28	464	45014	7010		
10/29	471	45014	3480		

A Page from the Loose-Leaf Inventory of Raw Stock; the Distribution by Departments is Shown

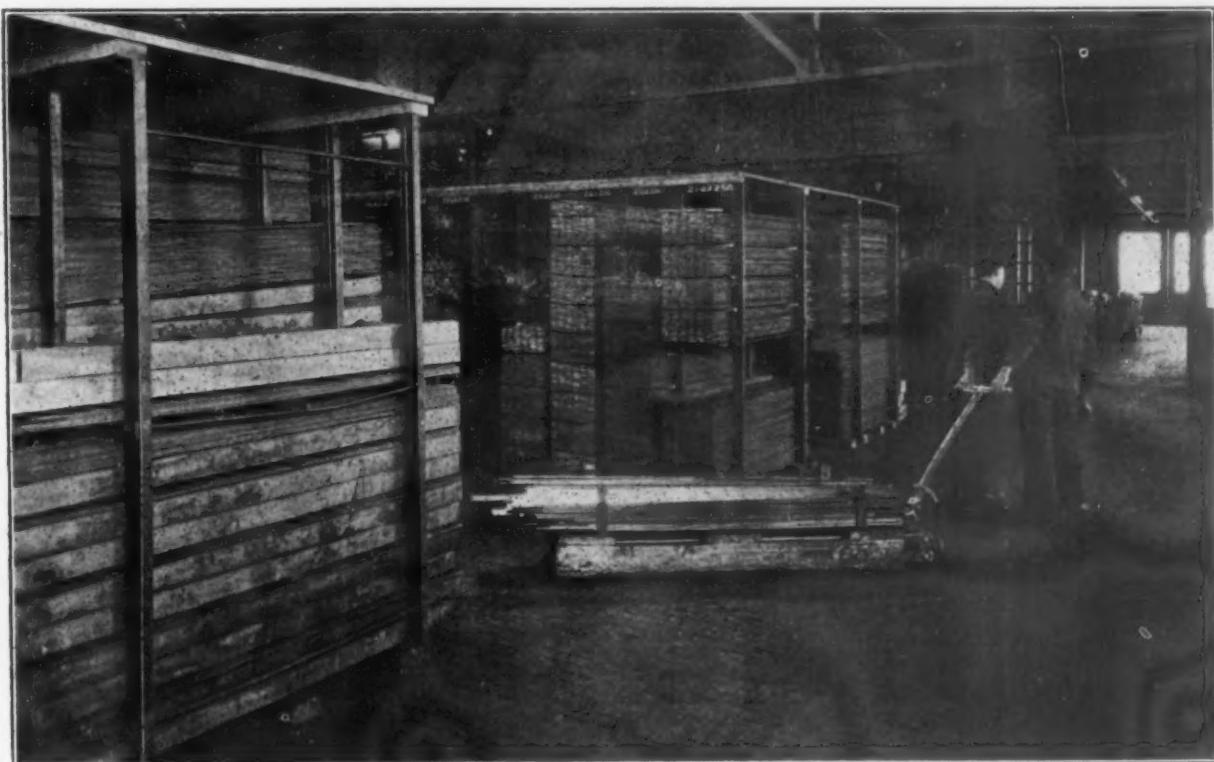
The Blanks Used When a Department Starts a Job of Manufacturing by Applying to the Planning Department

department there is marked upon it the kind of stock to be issued and the allowance. A clerk then proceeds to fill in a manufacturing order which is manifolded on four forms. A yellow original gives the date, order number, description, size of stock, allowance (weight), date completed and foreman. It has columns for date, operation, number, pounds produced and total pieces. This yellow sheet goes to the head of the department, and when the operation is completed it is returned by him to the planning department and by them, after inspection, sent to the cost department as an additional check against the cost card.

When writing the yellow sheet a carbon copy is made upon a manila card which has columns for date, amount delivered and balance due. This manila card goes direct to the steel room and when the requisition is filled is put into its permanent files.

A second operation is the filling out of another yellow sheet, precisely like the first one, which is put into the files of the planning department. In the writing of this a carbon copy is made upon a blue card which goes direct to the cost department. This has columns for the date, operation number, cases produced and labor. It has also an itemized list for sub-division of the labor and material costs.

It has been found that the method of piling bars in 1-ton lots has several advantages. It gives a quick means of making a physical inventory at any time to check against the perpetual inventory. It also enables the man filling requisitions to estimate very closely to the correct weight put upon the skid at the first trial. During the year a large volume of stock is handled, yet the perfection of the system by skillful planning and much care in the delivery to the job is such that it rarely happens that stock reaches a department in excess of the allowance given by the planning department. A check is thus kept upon extravagant use of stock or waste in any of the operations. If an operator is unable to complete a job without calling for more stock, the planning department, the foreman of the steel room and the foreman of the department im-



The bar stock is put into racks with wood cross ties separating each ton lot. Plentiful allowance is made for the movement of trucks. Special skids and elevating conveyor trucks are used for nearly all trucking.

mediately get busy ascertaining just where the trouble lies. After an operator has become familiar with this system and the various ways in which the care he exercises is checked by purely routine methods, he learns to become careful and accurate.

The planning department has succeeded in getting its allowance so close to the amounts required by the average operator that the amount of stock furnished for the job, let us say, of making 50,000 No. 9 Woodruff keys, will come out with less than a variance of 100 keys of the amount desired.

NEW UNIVERSAL TURRET LATHE

Machine Tool Handling Heavy Steel Forgings or High-Speed Brass Work

The Oliver Machinery Company, Grand Rapids, Mich., will shortly place on the market a heavy-duty screw machine and turret lathe built to meet the modern needs of high speeds and heavy duties. It is designed to cover a range of work from the heavy chucking of iron or steel forgings to high speeds of brass work. The legs are of the regular type, giving a solid, wide and substantial foundation. The weight of the machine is distributed throughout where the loads and strains exist and the bed is not left narrow or light for the pressed steel drip pan to stiffen.

The lathe is of friction back geared type controlled by a lever directly at the left of the operator. The headstock is cast integral with the bed and follows the contour of the cone pulley up to the centerline of the spindle, thus stiffening the head; it is solid underneath the cone pulley and of generous proportions throughout. The ways are flat, $1\frac{1}{8}$ in. thick and wide, and the width across the shears is exceptional for turret lathes of similar capacity. The depth of bed at the smallest section is 11 in. and the connecting sections are of the box type.

The gears in the friction back gear mechanism are entirely inclosed, the cover for the forward gears and frictions being instantly removable for inspection or adjustment. The adjustment of the friction rings is made by a single screw regulating the pressure of the rings. The friction is of the expanding ring type. Both front and rear spindle bearings are oiled by felt wipers extending down into capacious oil chambers.

When operated by power, six feeds are obtainable, ranging, in keeping with the turret, from 0.006 to 0.052 in., but these are entirely independent of the turret feeds, the combination of the two sets being quickly obtainable if desired. The power cross feed operates the carriage longitudinally in

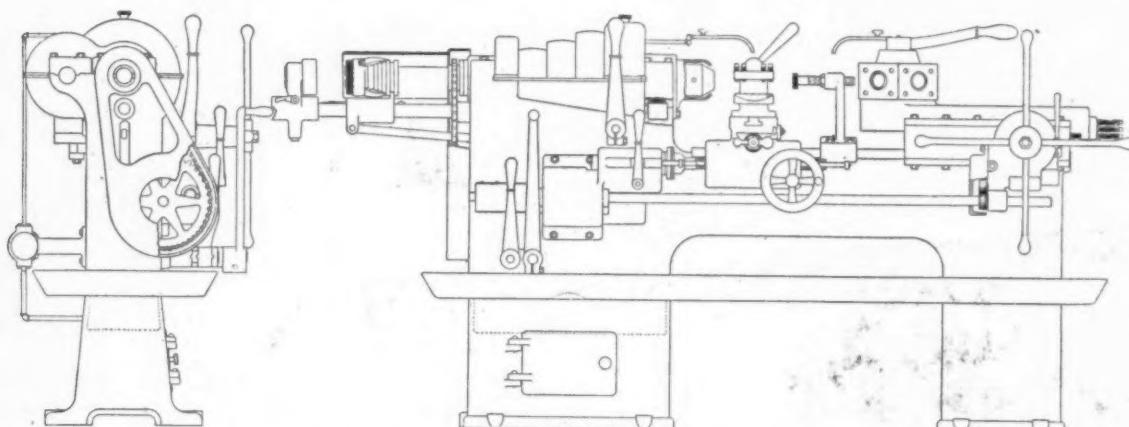
either direction or can operate the cross-slide forward or back by clamping the carriage to the bed shears and throwing the cross feed into play. Automatic throw-outs are provided in both the cross-slide and the carriage to disengage the power feeds and operate in both directions. A small lever controls the direction of the feed and cross-feed screws for accurate shoulder spacing work and reads to 0.001 in.

The cross-slide is flat and wide with two parallel T-slots in the rear and one at right angles in front, permitting a great variation of tools for cross-slide operation. Regular equipment includes an open side cut-off tool in the rear and a four-sided turret tool holder in the front. The latter clamps with a powerful lever and is convenient for all classes of work.

When not required, power feed may be omitted and hand-operated longitudinal feed provided. The cross-slide remains the same, the four-tool turret being replaced by a single-tool holder and the power gearing omitted. The handwheel is provided with dial reading to 0.001 in. for accurate turning longitudinally, while the cross-slide dial remains as for power feed. Longitudinal travel is the same with either power or hand feed. If desired, a lever cross-slide arrangement will be supplied in place of the screw feed. This is more rapid for some classes of work, but is not as general in its application as the screw cross feed.

The turret is made from special cast iron, bored and counterbored in position on the lathe to assure alignment. The clamping lever is unusually heavy and gives stability to the turret under a cutting load. The turret stud is $2\frac{1}{2}$ in. in diameter and drilled to permit stock for long screws or shafts up to the capacity of the machine to pass entirely through the turret. The locking plunger is hardened and ground tool steel, has a hardened tool steel seat and slides in a hardened and ground sleeve.

The turret slide is either power or hand fed. If power the following feeds may be employed, 0.006, 0.010, 0.015, 0.025, 0.040 and 0.052 in. per revolution of spindle. The control of these feeds is by a lever at the left of the gearbox and a plate and pointer will show exactly the feed given the turret. Being of the sliding key type the selection of feeds may be made when the machine is either running or idle. The turret slide is secured in place by taper gibbs on each side and by ample hold-down gibbs, all of which are hand scraped to a true bearing. The multiple stops projecting at the extreme right provide a throw-out for the power feed at each face of the turret and form a positive stop by a slight forward movement of the hand lever. The multiple-stop mechanism is directly geared to the turret head



Chuck of Heavy Steel or Iron Forgings as Well as the Handling of Brass Work at High Speeds Is Performed by this Heavy-Duty Screw Machine and Turret Lathe

and is not likely to get out of adjustment. The power feed mechanism consists of a steel rack and gears and a drop worm which is either released or thrown into mesh by opposite movements of the same lever, handily located for the operator.

The turret ways are adjustable on the shears of the bed, forward or backward to the limit of the length of bed and are clamped externally by large rectangular gibbs acting outside of the shears. Adjustment for wear is provided for by a large taper gib under the entire ways which is adjustable by two large fine-thread screws. The application of taper gibbs to the slides and ways is relied upon to give complete control of adjustment due to wear in any direction.

The change gear system consists of steel and cast-iron gears running in an oil bath and is of the sliding key type. A single lever controls both turret and cross feeds and a plate placed so as to readily be seen by the operator shows by means of a pair of pointers at just which rate the turret and cross-feed mechanisms are operating. All bearings in the gearbox are bronze bushed and the gears running in oil assure good continuous lubrication. The gearbox is located underneath the headstock, which is inclosed and chips and dirt cannot get in. It is easily accessible, being secured entirely from the front of the machine.

An independent and adjustable stock stop, clasped to the shears of the bed, is a regular part of the equipment of the universal turret lathe only. This stop allows the entire six faces of the turret to be used for cutting tools.

The wire feed lever is long and designed to give easy leverage to the feed mechanism. It is of the sliding cone type, with tool steel hardened dogs acting on a spring collet held in the automatic chuck. The chuck is hardened and ground and the work is thus held true to center. A guard over the automatic chuck prevents oil from flying over the room and the feeding mechanism in the rear has a metal guard to prevent accident from the rotating dogs.

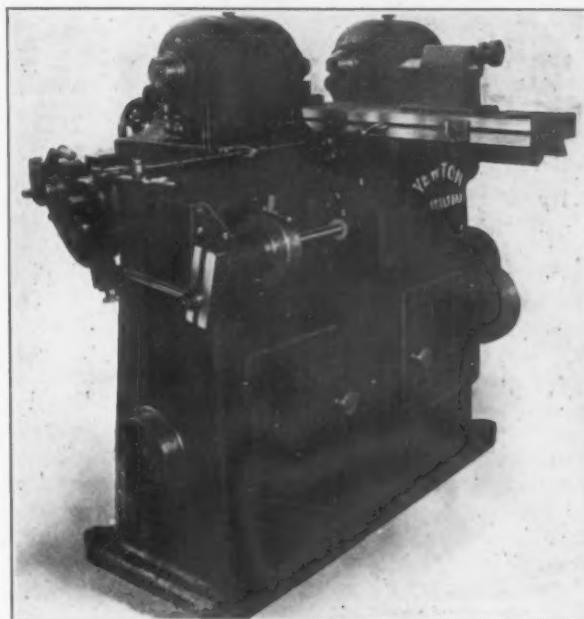
The pan is made of formed sheet steel, is stiff and light and extends entirely around the machine, being placed to allow easy cleaning of chips from underneath the bed. The oil or cutting lubricant reservoir is contained in the headstock leg and is of several gallons capacity. There is a perforated cover over the opening in the pan under the headstock. A large handhole plate in the rear of the lathe is readily removable for cleaning purposes, and to clean out the tank it is not necessary to remove the pump or piping. The pump is of the reversible type, giving a large steady flow of lubricant to each of the two spouts, one for the turret tool and one for the cross slide. The pump is driven directly from the countershaft and is therefore independent of the speed of the spindle or cutting feeds.

Norway exported 9910 metric tons of ferrosilicon in 1915, against 6144 and 6323 tons in 1914 and 1913, respectively. Iron ore and iron-ore briquette exports were 423,400 tons last year, against 467,800 tons in 1914, and 568,800 tons in 1913. Total imports of pig iron and finished steel were 302,200 tons in 1915, as compared with 223,200 tons in 1914 and 219,700 tons in 1913. Of these totals the pig-iron imports were 33,200 tons in 1915 and 32,200 tons and 30,700 tons in 1914 and 1913 respectively.

Chilean exports of bar copper in 1915 were 45,022 tons, against 25,795 tons of bar copper and 15,987 tons of copper ingots in 1914. In January, 1915, the price was \$287 per ton; in June, \$410.60 per ton, and in December, \$418.50 per ton.

Machine Milling Two Keyseats at Once

The Newton Machine Tool Works, Inc., Philadelphia, Pa., has designed and installed in its plant a new design of duplex keyseat milling and cotterizing machine. It is explained that the production possible is increased and the time lost in laying out



A Duplex Milling Machine Capable of Cutting Keyseats in Opposite Sides of a Shaft Simultaneously

the work where two keyseats are cut in opposite sides of a shaft is eliminated. The machine is designed to handle shafts up to a maximum diameter of 4 in. and the width of keyseats that can be cut ranges from $\frac{1}{8}$ to $\frac{3}{4}$ in.

The spindles have double taper bearings and are 2 $\frac{11}{16}$ in. in diameter at the large end of the taper and 1 $\frac{5}{16}$ in. at the driving section. An adjustment is provided whereby the distance between the ends of the spindles can be varied from 0 to 10 in. Draw-in collets are furnished and the spindle heads have automatic feed with a safety release for use in cotterizing, the maximum feed being $\frac{1}{16}$ in. per stroke of the table. There are four geared speed changes provided for the spindle without removing gears, and this is doubled by the back gears on each head, giving a range of 300 to 1465 r.p.m. The higher speeds are, of course, obtained by an open belt and the slower ones through the engagement of the individual sets of back gears on the heads.

Power is supplied from a countershaft pulley 20 in. in diameter with a $2\frac{3}{4}$ -in. face running at 365 r.p.m. From this pulley power is transmitted to the driving pulley, which is 10 in. in diameter with a $2\frac{1}{4}$ -in. face. This pulley, which operates at 730 r.p.m., has drums 12 in. in diameter with an 8-in. face mounted upon the same shaft inside the base which are connected by belts to the spindles.

The work table or cross carriage has an over-all length of 44 in. and 38 $\frac{1}{2}$ in. over the finished surface. It measures 9 in. in width and has three feed changes, the feed being either continuous for long splines or reversing automatically for cotterizing. The maximum cross feed to the carriage is 24 in. and the height from the table to the center of the spindles is $3\frac{1}{2}$ in.

A fixture has been developed for the builder's slotting machine for use in connection with the milling machine for cutting both internal keys at one time. In this way, it is pointed out, an accurate fit of the keys on all sides is assured.

Buying Material on a Scientific Basis

The Position Purchasing Occupies in Business—Points to Be Considered in Placing Orders—Question of Terms and Delivery

BY H. B. TWYFORD*

The function of buying holds an important strategic position in the great complex structure called business, in that it precedes every other activity. Developments in the art affect every undertaking in the realm of transportation, manufacturing, construction or commerce. Regulated and right buying is a study in economics, and its proper performance has a positive favorable influence on the profits, whereas promiscuous buying is a serious handicap to any concern.

Since the world began property of all kinds has been bartered, traded, exchanged, bought and sold. There always have been two parties to the transaction and always will be. In fact, all human effort is dual in its nature so the seller will continue to exist just as long as the buyer does and there are transactions to be negotiated pertaining to the change of ownership of any kind of property.

Scientific buying means not only that the function of purchasing itself is conducted at a higher percentage of efficiency, but that important economic advantages are secured for the other departments of an establishment. This should be apparent in a factory, or a railroad or in construction work. But it has a wider significance which affects the entire business world—it does materially reduce the cost of selling—and this is one of its chief claims to greater recognition.

STRATEGY—BUT NOT SCIENCE

One of the arguments put forth by a theorist for the elimination of the salesman is given here as it will lead to a better appreciation of the fundamental principles of scientific buying when they are discussed. It is related of a company which purchased articles that had been established as standard by them. They had thoroughly canvassed the market and placed orders for these articles with a manufacturer who had given them a satisfactory price and delivery. When it became necessary to place repeat orders for these articles the buyer proceeded on the basis that the seller would not incur any expenses in obtaining the order and that he (the buyer) was entitled to a lower price, the reduction to be equal to the amount previously added by the seller to the cost of the article for selling expenses.

The executives and officials of the company manufacturing the articles were approached in an informal and pleasant manner by the purchaser who after discussing some business generalities, adroitly turned the conversation into the channel of costs and finally obtained from them a very fair idea of the manner in which they distributed them.

Armed with this information, the buyer when next placing an order for the articles exactly of the same quality and description as previously furnished, put forth the claim that as there were no selling expenses incurred by the manufacturer in obtaining the order, he (the buyer) was entitled to a reduction in the price and having ascertained

through his previous conversation with the manufacturer, the percentage his selling expenses bore to the price, he finally was able to place the order with this percentage deducted.

This is a piece of strategy which can be viewed from many angles, but to claim it as scientific buying is a fallacy. Have the seller's expenses actually been reduced? If not, then some buyer has got to pay them. If a manufacturer had a sufficient number of customers similar to the one mentioned in the above instance, he could dispense with salesmen entirely; in fact, his selling expenses would be nil. But if he were without a selling organization and he should lose the orders, he would be stranded. Certainly a buyer who placed an order under the circumstances cited would not hesitate about deserting his regular source of supply and buying elsewhere if he saw a pecuniary advantage in doing so.

Suppose we give the buyer credit for the intention to give the business to the same manufacturer permanently, can he guarantee to do it in view of the continual changes in manufacturing methods and processes, and in the raw materials which enter into the products? In view of these, is it not necessary to canvass the market periodically for prices? If a manufacturer accepted business under the conditions named and subsequently discovered that by some improved manufacturing methods he could substantially reduce his costs, would he give the advantage of the reduction to such a buyer? It is not conceivable that he would voluntarily give any concession in price and would only do so when brought into competition again with other manufacturers. It is necessary, therefore, to get revised prices and quotations periodically, however stable the product.

ILLUSTRATIONS OF INEFFICIENT BUYING

Whatever the contentions and arguments advanced in favor of proceeding along such lines as outlined, it is not scientific buying. Scientific buying, however, does reduce the cost of selling and any economies achieved in this direction by the better methods of the purchasing department of any organization must ultimately have its effect on prices. As an illustration, the writer knows of an order which was placed for a large number of spiral springs. When the manufacturers were asked to quote on these, only 40 per cent of them were able to bid. Of the remaining 60 per cent some did not make the particular kind of spring required, some were specialists in elliptical springs, some made only springs of larger diameter wire and some only of smaller diameter wire. The efforts of the purchaser were wasted to the extent of 60 per cent and the same percentage of the manufacturers incurred an addition to their selling expenses in answering these inquiries without any hope of securing business.

Another illustration is where an inquiry is sent out asking for quotations and is so ambiguously worded that considerable uncertainty exists among the bidders as to what is required. In these cases salesmen are frequently sent to call and make in-

*Purchasing department Otis Elevator Company, New York City, and author of "Purchasing, Its Economic Aspects and Proper Methods."

quiries or the loose wording of the inquiry involves correspondence to clear up the moot points. Such incidents as these undoubtedly increase the selling expenses of practically all business concerns. These expenses must be charged to the cost of the goods and eventually paid for by the buyer.

SALESMANSHIP AND THE ART OF BUYING

In spite of the fact that enormous educational efforts are directed toward attaining more scientific salesmanship, it cannot altogether cope with such situations as are created by unscientific buying and largely for this reason the cost of selling is disproportionate to the other expenses which are loaded on the cost of an article before it finally reaches the consumer.

This disproportion can be brought into proper relation with other expenses only by more scientific buying. Certainly scientific salesmanship has not accomplished it. Both selling and buying need to be treated and considered more on the lines of economic studies. If by better and more accurate methods a buyer is enabled to reduce selling costs he will eventually obtain positive and direct benefits in the matter of prices and at the same time operate his own department at a higher degree of efficiency and lower cost. The education in the art of selling has been devoted too largely to schemes for getting business, irrespective of wasted effort, while the tendency in buying has been to sacrifice too much effort through lack of more complete knowledge and in inaccurate methods with unproductive results. The crying need of the business world to-day is to rectify these matters, and whatever can be accomplished will assuredly benefit both parties to a transaction.

WHERE AND WHAT QUANTITY TO BUY

One of the first objects to be striven for is the avoidance of promiscuousness, either in canvassing the market for prices and quotations or in placing orders. The harmful results in wasted effort and loss of efficiency caused by sending out invitations to tender broadcast have already been pointed out. The remedy for this is a closer and better knowledge of sources of supply. Exact information can be accumulated and registered by the purchasing agent of all those concerns he is buying from or may buy from not only as to the nature of their product but also the quantities they are able to turn out in a stipulated time, whether they keep their promises, whether they are located geographically to serve the buyer to the best advantage, whether they are hampered financially or through lack of the requisite facilities to take care of his business.

The buyer need have no uncertain feeling in placing an order if he has the right information on file. The concerns he has asked to bid are the best in the country to serve him and give him best prices. He knows his order will receive proper attention, and any doubts as to its being executed in accordance with its terms and conditions are practically eliminated. He also has the satisfaction of knowing that this has been accomplished with the minimum amount of effort and expense to his own concern and also to those who catered for his business.

In these days of freight embargoes, geographical considerations are important. Those locations which admit of free movement of freight between the point of shipment and destination should be favored. It is not good policy at any time to be entirely dependent on one source of supply or on one transportation line. Strikes, breakdowns and other interruptions might seriously interfere with the delivery of the goods ordered and the economic ben-

efits of having placed an order advantageously be lost.

Buying the right quantity is just as important a feature as buying from the right supplier. It is just as poor policy to buy too much as too little. The reasons for this are obvious and it is only by scientific methods that the correct quantity can be ascertained.

The question of quantity is not always left to the decision of the purchasing agent, but he can always have a voice in deciding it. If for instance he has kept proper records, he can forecast with considerable accuracy the trend of market prices. On a declining market the proposition is fairly simple, but the reverse conditions involve questions of financing the purchases, storing the material until consumed or resold, if arrangements cannot be made to take shipments in quantities as required. Every buyer at times has offers made to him of larger quantities than he contemplates ordering at lower prices. If a ready market can be found, well and good, but if not, the actual price paid for the goods is not their true cost. To this price must be added cost of financing, storage, insurance, etc.

One cannot always buy for the future on the basis of consumption in the past, nevertheless records of the quantities consumed over a given period are extremely valuable in determining how much to buy. If the purchasing is being done for a factory making a well established and standardized product, it is almost as simple a proposition to specify future quantities required as to tabulate quantities consumed in the past. But in those factories where constant changes are taking place in the product and new articles being made it is sometimes exceedingly difficult to gage the quantities. In these cases the sales manager and production manager must be called into consultation and their views, combined with the purchasing agent's forecast as to prices, should determine the matter.

SPECIFICATIONS AND REPORTS ON MATERIALS

It is imperative that correct specifications be on file and accompany every order placed and every request for quotations. This specification may be only a few words or figures giving dimensions, but of whatever it consists, it must be worded in such a manner that no misconception can possibly exist as to the nature, quality and size of the material or article it covers. If this is strictly adhered to, it will be conducive toward the smooth, efficient and economic operation of the department and save time, expense and annoyance to the recipients. It also emphasizes the point already made that anything which can be done to save money for the seller eventually means a saving for the buyer. This feature is one to which closer attention could be paid by the great majority of buyers.

To determine that the material bought is actually being delivered, and to add to his knowledge of his purchases, a buyer should have reports regarding the quality of articles and materials. These reports may be made by inspectors appointed to test and inspect the material in process of fabrication in the supplier's factory or in the course of its progress through the buyer's factory.

There are also large numbers of small articles received into stores which must be checked and examined before placing them in the bins. Considerable variation is frequently seen in the products of manufacturers. Although apparently supplying the same article at the same price, one may be rougher in finish or not quite as accurate in size or carelessly packed. Reliable reports on all these points should be furnished to the purchasing department and

properly tabulated there in the information bureau.

It is a debatable point whether the inspection of material purchased should be under the control or independent of both the purchasing agent and user of the material, but there is no question as to the advisability of the purchasing agent accumulating all the information possible regarding the material and articles he buys. This knowledge of materials is exceedingly useful to the buyer in those cases where substitutes are offered in place of the regular material. A decision can usually be given on the matter at once without reference to other departments and considerable time and trouble saved.

QUESTION OF PRICE NOT ALL IMPORTANT

A buyer goes into the market to purchase at the lowest possible price the particular grade or quality already determined as being most suitable for uses to which the material or article is to be put. If price is made the sole consideration in buying, and persisted in, it will have a tendency to force manufacturers to produce a cheaper product, and this policy has elements of danger. Price and quality must be considered together. They cannot be divorced in making a purchase. It is obvious that if the quality is not suitable for one's purpose the price is of minor or secondary importance. This question of quality applies to both higher and lower grades. A better quality might have constituents which to the user or in the manufacturing process might prove objectionable. It is essential, therefore, that the quality shall have been predetermined. The determination of quality is not always within the province of the purchasing agent, but it has to be definitely decided before he goes into the market.

Competition will help to settle the buyer's convictions that he is paying the right price, but, as already pointed out, this competition must be between those firms who are in the best position to supply one's needs. A record of prices paid in the past will serve as a guide together with the present condition of the market.

BUYING FOR THE FUTURE

Close observation of the tendency of the market will often prove extremely valuable in coming to a decision as to how far ahead of requirements purchases should be made. Good judgment in this connection will largely add to the profits of many concerns. This has been called scientific guessing, but it is far from that and is also entirely distinct from speculation. The greatest financial successes have been created through buying for future rather than immediate profits, and the element of risk is almost entirely eliminated when the purchasing agent knows he has an output for his purchases and has adequately informed himself regarding market conditions and prospects.

In buying ahead of requirements, shipments should be arranged on a schedule to conform closely to consumption demands, otherwise many additional features must be calculated and taken into consideration. If it means tying up money, the loss of interest must be computed, or if it means the occupation of additional storage space, the rental value must be estimated, also the larger insurance it may be necessary to carry. If the goods are liable to deterioration, this fact must not be overlooked.

CASH DISCOUNTS, TERMS AND CONDITIONS

In certain lines of goods and certain trades there are established rules and terms which are supposed to be strictly adhered to. Nevertheless, they are sometimes deviated from, and in other transactions where no fixed rules abound it is always open to the

buyer and seller to arrange terms. This is a powerful factor in determining the economy of a purchase and large use can be made of it in closing a negotiation. It is not the regular terms recognized and allowed in many lines of business that it is desired to call attention to. It is assumed that these can be obtained practically without asking, but where larger cash discounts can be secured or better terms arranged, substantial savings can be effected, and these are the cases on which emphasis is laid. Taking 30 days as the net time for payment, if the seller can be made to concede an extra half of 1 per cent for cash in 10 days, it means that he is willing to forego this percentage to obtain his money 20 days earlier, which is equivalent to over 9 per cent per annum; 1 per cent for the same period is just double this, and 2 per cent is over 30 per cent per annum. If the net time is 60 days, these percentages are 3.65, 7.30 and 14.60 respectively.

If his concern has to borrow money at 6 per cent to take advantage of these cash discounts, a buyer can figure out to what extent savings can be effected. It must not be overlooked, however, that the exact amount cannot always be borrowed for the exact time between the discount date and maturity date of an invoice, therefore, a certain amount of borrowed money will be idle, but not in sufficient amount to offset some of the advantages gained.

The time of the payment is also an important factor, particularly with those concerns working on a limited amount of capital, and in such cases a buyer can be of considerable value if he can arrange payments on long time, but if this has to be done at a sacrifice of price or cash discount, probably no saving will be effected. If facilities are available for borrowing money at the usual recognized commercial rates, it will generally be found that it is economically advantageous to do this and secure the cash discount rather than buy on extended time. It is of paramount importance to first secure the lowest price and then the longest time or the largest cash discount. Having obtained from the seller every possible concession in the matter of time and discount a review of the financial position of the buying concern will determine on which basis to close the transaction.

Transportation charges bear an important relation to the cost of some goods and must be given due consideration. To relieve his concern as much as possible, every purchasing agent should endeavor to make the seller pay transportation charges. If a price has been quoted f.o.b. point of shipment with freight allowed to destination, it means that the buyer has to provide finances for freight payments with the attendant clerical work of checking freight bills and having in force an infallible system by which these charges are debited to the seller.

If a buyer can arrange for all such shipments f.o.b. destination, freight prepaid, it means that he is securing for his concern very appreciable economic benefits. To go still further with this question of freight, it is possible in some cases to negotiate successfully with the seller for its prepayment even in those cases where the price has been agreed upon f.o.b. point of shipment, without any freight allowance. In these instances the buyer is getting the seller to carry his freight bills for him and the conditions mentioned in the last paragraph are reversed.

GETTING DELIVERY OF PURCHASES

If a purchase has been made on the most favorable basis as to all its terms and conditions and at the lowest obtainable price, all these economic benefits might be lost if the goods were not delivered on

time. It is imperative, therefore, due provision be made in the arrangement of the routing work of the buyer's office to follow these orders up and obtain shipment at the required time.

If the goods are bought for resale, the market for them might be lost in case of non-delivery, and if they are for manufacturing purposes a whole factory may be tied up or its work dislocated or hindered to such an extent as to involve heavy losses. In construction work a delay in receiving one item of material may entail serious consequences through the stoppage, not only of the particular work for which the material was needed, but other work which was contingent to it.

INVOICES AND PAYMENT

It is incumbent on the purchaser not only to buy and obtain delivery, but also to satisfy himself that the cash discounts, terms, conditions and other benefits he contracted for when closing the negotiation are positively secured. To insure this, it is essential that invoices be obtained from the seller in good time and that they are properly checked, approved and passed through his office for payment strictly in accordance with the terms of the agreement made at the time the order was placed.

A problem in connection with payments is when the point of shipment is at such a distance from destination that it is impossible to get delivery of the goods, properly check and examine them and approve the invoice in time to make the payment before the discount period expires. In these cases it is sometimes possible to obtain from the seller an extension of the time in which the discount is available or even to make this time date from arrival of goods at buyer's factory. When this cannot be done, the payment can be made in advance of the receipt and checking of the goods, but the purchaser must be doing business with reliable concerns whom he will have already selected by his process of elimination and selection already described.

Heat Losses in the Gas Engine

The distribution of the heat in gas-engine cylinders was the subject of a research made by Prof. A. H. Gibson and W. J. Walker at the engineering laboratories of University College, Dundee, Scotland, and described in a paper read before the Institution of Mechanical Engineers. The water jacket was divided into two parts, one covering the exhaust valve and that part of the cylinder containing the exhaust passage, while the other covered the cylinder barrel and the breech end. This arrangement enabled heat losses to be properly divided between jacket and exhaust losses. The research was made to ascertain the variation in heat distribution with variations in speed, brake horsepower, compression and the richness of the air-gas mixture.

The mechanical efficiency increased with increasing loads, diminished with increases of the air-gas ratio and speed, and was independent of the compression ratio, which varied between the limits of 5.17 and 6.62. The maximum efficiency was 88 per cent, obtained at full load with the richest (7:1) air-gas mixture, and at 150 r.p.m., the lowest speed. With the same mixture and at the normal speed of 200 r.p.m., the efficiency was 85 per cent. At normal speed and with an 11:1 mixture the efficiency was 76.7 per cent. The thermal efficiency increased with the load and compression ratio. Measured by the indicated horsepower, it increased slightly with an increase of speed, and reached a maximum with an air-gas mixture of 10:1. Measuring the thermal efficiency by the brake horsepower, the maximum was attained with an air-gas ratio of 8:1.

The percentage of exhaust losses diminished with increases of load and compression ratio, and slightly with increased air-gas ratio. They increased with the speed. The exhaust losses ranged from 33.6 per cent

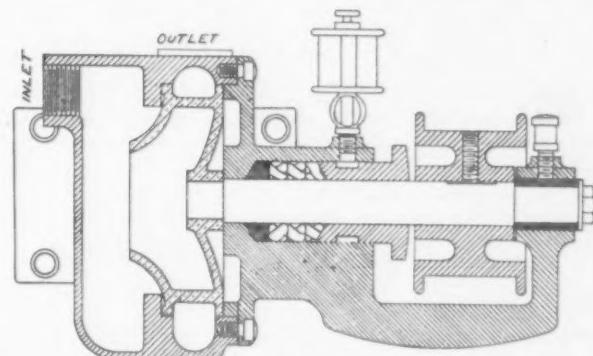
with a weak mixture, high compression and low speed to 42.5 per cent with a rich mixture, low compression and high speed.

The percentage of heat carried away by the jacket water, exclusive of the exhaust valve jacket, increased with the load, diminished with an increase of the air-gas ratio and the speed, and was independent of the compression ratio. With a 7:1 mixture at full load the percentage of heat transmitted to the jackets was 1.10 times as great at 150 r.p.m. as at 250 r.p.m. With an 11:1 mixture this ratio became 1.23. The rate of heat transmission through the cooling surfaces is more rapid at the highest speed.

The heat lost by radiation from the hot exposed surfaces of the piston and of the unjacketed portion of the breech, and from the outer surface of the jackets diminished as the load and speed increased, but increased with increases of the air-gas ratio, and slightly with increases in the compression ratio. At full load, radiation accounted for from 5 to 14 per cent of the heat delivered to the engine. The former value was obtained with a rich mixture, high speed and low compression ratio; the latter with a weak mixture low speed and high compression ratio. The percentage value of the heat entering the exhaust valve jacket ranged from 8.0 to 12.5. It is greatest at low loads, low speeds and with low compression ratios and rich mixtures. If this be added to the jacket loss it gives the jacket loss as determined by trials of an engine fitted with the ordinary jacket arrangement.

A Grinding Machine Circulating Pump

A substitute for the submerged fan type pump formerly used on the grinding machine has been brought out by the Cincinnati Lubricant Pump Company, Cin-



Sectional Elevation of a Centrifugal Circulating Pump for Grinding Machines

cinnati, Ohio. It is of the centrifugal type and one of the special features is the absence of bearings in the pump proper. It is also explained that the pump can be mounted above the level of the liquid being handled and will retain its prime without the aid of a check valve or other working parts on account of the positive trap arrangement forming a part of the design.

The outer shaft bearing is of phosphor bronze and takes care of the end thrust, while the inner bearing, which is cast iron, is combined with the stuffing box gland, a combination of metallic, graphite, rubber and flax packings being relied upon to guard this bearing against the entrance of emery, grit and dirt. Semi-automatic lubrication for both bearings is furnished from large oil reservoirs.

With a suction lift of 12 in. and a head lift of 4 ft. the pump will deliver 5 gal. per minute with a pulley speed of 1200 r.p.m. This flow can be increased to 15 gal. by causing the pulley to operate at 1600 r.p.m., and if a greater flow at this head lift or the same flow at a greater lift is desired, the speed of the pump pulley is augmented.

Recent statistics issued by the Japanese Government show that the number of vessels being built at Japanese shipyards is 99, with an aggregate tonnage of 439,470.

of delivery to any department, the department or invoice number, the number of the steel order or

Page from the Longleaf Inventory of Raw Stock; the distribution by Departments is shown.

mediately get busy ascertaining just where the trouble lies. After an operator has become familiar with this system and the various ways in which the care he exercises is checked by purely routine methods, he learns to become careful and accurate.

The planning department has succeeded in getting its allowance so close to the amounts required by the average operator that the amount of stock furnished for the job, let us say, of making 50,000 No. 9 Woodruff keys, will come out with less than a variance of 100 keys of the amount desired.

NEW UNIVERSAL TURRET LATHE

Machine Tool Handling Heavy Steel forgings or High-Speed Brass Work

The Oliver Machinery Company, Grand Rapids, Mich., will shortly place on the market a heavy-duty screw machine and turret lathe built to meet the modern needs of high speeds and heavy duties. It is designed to cover a range of work from the heavy chucking of iron or steel forgings to high speeds of brass work. The legs are of the regular type, giving a solid, wide and substantial foundation. The weight of the machine is distributed throughout where the loads and strains exist and the bed is not left narrow or light for the pressed steel drip pan to stiffen.

The lathe is of friction back geared type controlled by a lever directly at the left of the operator. The headstock is cast integral with the bed and follows the contour of the cone pulley up to the center-line of the spindle, thus stiffening the head; it is solid underneath the cone pulley and of generous proportions throughout. The ways are flat, $1\frac{1}{8}$ in. thick and wide, and the width across the shears is exceptional for turret lathes of similar capacity. The depth of bed at the smallest section is 11 in. and the connecting sections are of the box type.

The gears in the friction back gear mechanism are entirely inclosed, the cover for the forward gears and frictions being instantly removable for inspection or adjustment. The adjustment of the friction rings is made by a single screw regulating the pressure of the rings. The friction is of the expanding ring type. Both front and rear spindle bearings are oiled by felt wipers extending down into capacious oil chambers.

When operated by power, six feeds are obtainable, ranging, in keeping with the turret, from 0.006 to 0.052 in., but these are entirely independent of the turret feeds, the combination of the two sets being quickly obtainable if desired. The power cross feed operates the carriage longitudinally in

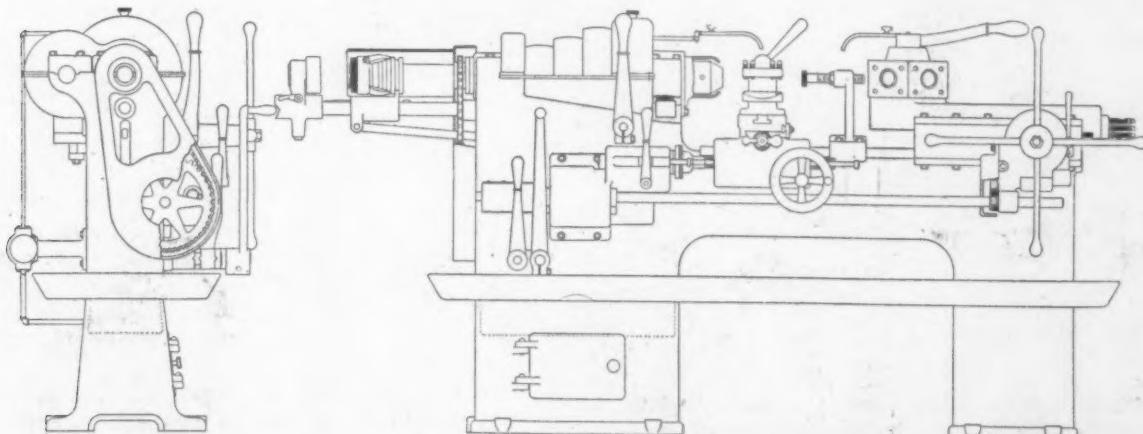
either direction or can operate the cross-slide forward or back by clamping the carriage to the bed shears and throwing the cross feed into play. Automatic throw-outs are provided in both the cross-slide and the carriage to disengage the power feeds and operate in both directions. A small lever controls the direction of the feed and cross-feed screws for accurate shoulder spacing work and reads to 0.001 in.

The cross-slide is flat and wide with two parallel T-slots in the rear and one at right angles in front, permitting a great variation of tools for cross-slide operation. Regular equipment includes an open side cut-off tool in the rear and a four-sided turret tool holder in the front. The latter clamps with a powerful lever and is convenient for all classes of work.

When not required, power feed may be omitted and hand-operated longitudinal feed provided. The cross-slide remains the same, the four-tool turret being replaced by a single-tool holder and the power gearing omitted. The handwheel is provided with dial reading to 0.001 in. for accurate turning longitudinally, while the cross-slide dial remains as for power feed. Longitudinal travel is the same with either power or hand feed. If desired, a lever cross-slide arrangement will be supplied in place of the screw feed. This is more rapid for some classes of work, but is not as general in its application as the screw cross feed.

The turret is made from special cast iron, bored and counterbored in position on the lathe to assure alignment. The clamping lever is unusually heavy and gives stability to the turret under a cutting load. The turret stud is $2\frac{1}{2}$ in. in diameter and drilled to permit stock for long screws or shafts up to the capacity of the machine to pass entirely through the turret. The locking plunger is hardened and ground tool steel, has a hardened tool steel seat and slides in a hardened and ground sleeve.

The turret slide is either power or hand fed. If power the following feeds may be employed, 0.006, 0.010, 0.015, 0.025, 0.040 and 0.052 in. per revolution of spindle. The control of these feeds is by a lever at the left of the gearbox and a plate and pointer will show exactly the feed given the turret. Being of the sliding key type the selection of feeds may be made when the machine is either running or idle. The turret slide is secured in place by taper gibbs on each side and by ample hold-down gibbs, all of which are hand scraped to a true bearing. The multiple stops projecting at the extreme right provide a throw-out for the power feed at each face of the turret and form a positive stop by a slight forward movement of the hand lever. The multiple-stop mechanism is directly geared to the turret head



Chuckling of Heavy Steel or Iron forgings as well as the handling of Brass Work at High Speeds is performed by this Heavy-Duty Screw Machine and Turret Lathe.

and is not likely to get out of adjustment. The power feed mechanism consists of a steel rack and gears and a drop worm which is either released or thrown into mesh by opposite movements of the same lever, handily located for the operator.

The turret ways are adjustable on the shears of the bed, forward or backward to the limit of the length of bed and are clamped externally by large rectangular gibbs acting outside of the shears. Adjustment for wear is provided for by a large taper gib under the entire ways which is adjustable by two large fine-thread screws. The application of taper gibbs to the slides and ways is relied upon to give complete control of adjustment due to wear in any direction.

The change gear system consists of steel and cast-iron gears running in an oil bath and is of the sliding key type. A single lever controls both turret and cross feeds and a plate placed so as to readily be seen by the operator shows by means of a pair of pointers at just which rate the turret and cross-feed mechanisms are operating. All bearings in the gearbox are bronze bushed and the gears running in oil assure good continuous lubrication. The gearbox is located underneath the headstock, which is inclosed and chips and dirt cannot get in. It is easily accessible, being secured entirely from the front of the machine.

An independent and adjustable stock stop, clasped to the shears of the bed, is a regular part of the equipment of the universal turret lathe only. This stop allows the entire six faces of the turret to be used for cutting tools.

The wire feed lever is long and designed to give easy leverage to the feed mechanism. It is of the sliding cone type, with tool steel hardened dogs acting on a spring collet held in the automatic chuck. The chuck is hardened and ground and the work is thus held true to center. A guard over the automatic chuck prevents oil from flying over the room and the feeding mechanism in the rear has a metal guard to prevent accident from the rotating dogs.

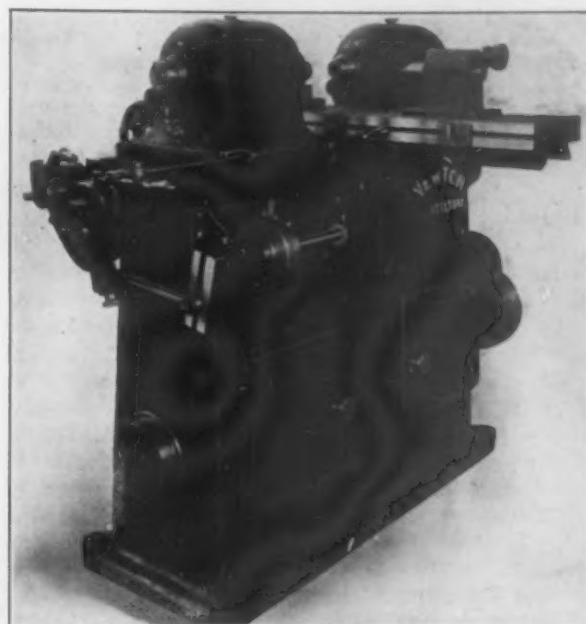
The pan is made of formed sheet steel, is stiff and light and extends entirely around the machine, being placed to allow easy cleaning of chips from underneath the bed. The oil or cutting lubricant reservoir is contained in the headstock leg and is of several gallons capacity. There is a perforated cover over the opening in the pan under the headstock. A large handhole plate in the rear of the lathe is readily removable for cleaning purposes, and to clean out the tank it is not necessary to remove the pump or piping. The pump is of the reversible type, giving a large steady flow of lubricant to each of the two spouts, one for the turret tool and one for the cross slide. The pump is driven directly from the countershaft and is therefore independent of the speed of the spindle or cutting feeds.

Norway exported 9910 metric tons of ferrosilicon in 1915, against 6144 and 6523 tons in 1914 and 1913, respectively. Iron ore and iron-ore briquette exports were 423,400 tons last year, against 467,800 tons in 1914, and 568,800 tons in 1913. Total imports of pig iron and finished steel were 302,200 tons in 1915, as compared with 223,200 tons in 1914 and 219,700 tons in 1913. Of these totals the pig-iron imports were 33,200 tons in 1915 and 32,200 tons and 30,700 tons in 1914 and 1913 respectively.

Chilean exports of bar copper in 1915 were 45,022 tons, against 25,795 tons of bar copper and 15,987 tons of copper ingots in 1914. In January, 1915, the price was \$287 per ton; in June, \$410.60 per ton, and in December, \$418.50 per ton.

Machine Milling Two Keyseats at Once

The Newton Machine Tool Works, Inc., Philadelphia, Pa., has designed and installed in its plant a new design of duplex keyseat milling and cotterizing machine. It is explained that the production possible is increased and the time lost in laying out



A Duplex Milling Machine Capable of Cutting Keyseats in Opposite Sides of a Shaft Simultaneously

the work where two keyseats are cut in opposite sides of a shaft is eliminated. The machine is designed to handle shafts up to a maximum diameter of 4 in. and the width of keyseats that can be cut ranges from $\frac{1}{8}$ to $\frac{3}{4}$ in.

The spindles have double taper bearings and are 2 $\frac{11}{16}$ in. in diameter at the large end of the taper and 1 $\frac{5}{16}$ in. at the driving section. An adjustment is provided whereby the distance between the ends of the spindles can be varied from 0 to 10 in. Draw-in collets are furnished and the spindle heads have automatic feed with a safety release for use in cotterizing, the maximum feed being $\frac{1}{16}$ in. per stroke of the table. There are four geared speed changes provided for the spindle without removing gears, and this is doubled by the back gears on each head, giving a range of 300 to 1465 r.p.m. The higher speeds are, of course, obtained by an open belt and the slower ones through the engagement of the individual sets of back gears on the heads.

Power is supplied from a countershaft pulley 20 in. in diameter with a $2\frac{3}{4}$ -in. face running at 365 r.p.m. From this pulley power is transmitted to the driving pulley, which is 10 in. in diameter with a $2\frac{1}{4}$ -in. face. This pulley, which operates at 730 r.p.m., has drums 12 in. in diameter with an 8-in. face mounted upon the same shaft inside the base which are connected by belts to the spindles.

The work table or cross carriage has an over-all length of 44 in. and 38 $\frac{1}{2}$ in. over the finished surface. It measures 9 in. in width and has three feed changes, the feed being either continuous for long splines or reversing automatically for cotterizing. The maximum cross feed to the carriage is 24 in. and the height from the table to the center of the spindles is $3\frac{1}{2}$ in.

A fixture has been developed for the builder's slotting machine for use in connection with the milling machine for cutting both internal keys at one time. In this way, it is pointed out, an accurate fit of the keys on all sides is assured.

Buying Material on a Scientific Basis

The Position Purchasing Occupies in Business—Points to Be Considered in Placing Orders—Question of Terms and Delivery

BY H. B. TWYFORD*

The function of buying holds an important strategic position in the great complex structure called business, in that it precedes every other activity. Developments in the art affect every undertaking in the realm of transportation, manufacturing, construction or commerce. Regulated and right buying is a study in economics, and its proper performance has a positive favorable influence on the profits, whereas promiscuous buying is a serious handicap to any concern.

Since the world began property of all kinds has been bartered, traded, exchanged, bought and sold. There always have been two parties to the transaction and always will be. In fact, all human effort is dual in its nature so the seller will continue to exist just as long as the buyer does and there are transactions to be negotiated pertaining to the change of ownership of any kind of property.

Scientific buying means not only that the function of purchasing itself is conducted at a higher percentage of efficiency, but that important economic advantages are secured for the other departments of an establishment. This should be apparent in a factory, or a railroad or in construction work. But it has a wider significance which affects the entire business world—it does materially reduce the cost of selling—and this is one of its chief claims to greater recognition.

STRATEGY—BUT NOT SCIENCE

One of the arguments put forth by a theorist for the elimination of the salesman is given here as it will lead to a better appreciation of the fundamental principles of scientific buying when they are discussed. It is related of a company which purchased articles that had been established as standard by them. They had thoroughly canvassed the market and placed orders for these articles with a manufacturer who had given them a satisfactory price and delivery. When it became necessary to place repeat orders for these articles the buyer proceeded on the basis that the seller would not incur any expenses in obtaining the order and that he (the buyer) was entitled to a lower price, the reduction to be equal to the amount previously added by the seller to the cost of the article for selling expenses.

The executives and officials of the company manufacturing the articles were approached in an informal and pleasant manner by the purchaser who after discussing some business generalities, adroitly turned the conversation into the channel of costs and finally obtained from them a very fair idea of the manner in which they distributed them.

Armed with this information, the buyer when next placing an order for the articles exactly of the same quality and description as previously furnished, put forth the claim that as there were no selling expenses incurred by the manufacturer in obtaining the order, he (the buyer) was entitled to a reduction in the price and having ascertained

through his previous conversation with the manufacturer, the percentage his selling expenses bore to the price, he finally was able to place the order with this percentage deducted.

This is a piece of strategy which can be viewed from many angles, but to claim it as scientific buying is a fallacy. Have the seller's expenses actually been reduced? If not, then some buyer has got to pay them. If a manufacturer had a sufficient number of customers similar to the one mentioned in the above instance, he could dispense with salesmen entirely; in fact, his selling expenses would be nil. But if he were without a selling organization and he should lose the orders, he would be stranded. Certainly a buyer who placed an order under the circumstances cited would not hesitate about deserting his regular source of supply and buying elsewhere if he saw a pecuniary advantage in doing so.

Suppose we give the buyer credit for the intention to give the business to the same manufacturer permanently, can he guarantee to do it in view of the continual changes in manufacturing methods and processes, and in the raw materials which enter into the products? In view of these, is it not necessary to canvass the market periodically for prices? If a manufacturer accepted business under the conditions named and subsequently discovered that by some improved manufacturing methods he could substantially reduce his costs, would he give the advantage of the reduction to such a buyer? It is not conceivable that he would voluntarily give any concession in price and would only do so when brought into competition again with other manufacturers. It is necessary, therefore, to get revised prices and quotations periodically, however stable the product.

ILLUSTRATIONS OF INEFFICIENT BUYING

Whatever the contentions and arguments advanced in favor of proceeding along such lines as outlined, it is not scientific buying. Scientific buying, however, does reduce the cost of selling and any economies achieved in this direction by the better methods of the purchasing department of any organization must ultimately have its effect on prices. As an illustration, the writer knows of an order which was placed for a large number of spiral springs. When the manufacturers were asked to quote on these, only 40 per cent of them were able to bid. Of the remaining 60 per cent some did not make the particular kind of spring required, some were specialists in elliptical springs, some made only springs of larger diameter wire and some only of smaller diameter wire. The efforts of the purchaser were wasted to the extent of 60 per cent and the same percentage of the manufacturers incurred an addition to their selling expenses in answering these inquiries without any hope of securing business.

Another illustration is where an inquiry is sent out asking for quotations and is so ambiguously worded that considerable uncertainty exists among the bidders as to what is required. In these cases salesmen are frequently sent to call and make in-

*Purchasing department Otis Elevator Company, New York City, and author of "Purchasing, Its Economic Aspects and Proper Methods."

quiries or the loose wording of the inquiry involves correspondence to clear up the moot points. Such incidents as these undoubtedly increase the selling expenses of practically all business concerns. These expenses must be charged to the cost of the goods and eventually paid for by the buyer.

SALESMANSHIP AND THE ART OF BUYING

In spite of the fact that enormous educational efforts are directed toward attaining more scientific salesmanship, it cannot altogether cope with such situations as are created by unscientific buying and largely for this reason the cost of selling is disproportionate to the other expenses which are loaded on the cost of an article before it finally reaches the consumer.

This disproportion can be brought into proper relation with other expenses only by more scientific buying. Certainly scientific salesmanship has not accomplished it. Both selling and buying need to be treated and considered more on the lines of economic studies. If by better and more accurate methods a buyer is enabled to reduce selling costs he will eventually obtain positive and direct benefits in the matter of prices and at the same time operate his own department at a higher degree of efficiency and lower cost. The education in the art of selling has been devoted too largely to schemes for getting business, irrespective of wasted effort, while the tendency in buying has been to sacrifice too much effort through lack of more complete knowledge and in inaccurate methods with unproductive results. The crying need of the business world to-day is to rectify these matters, and whatever can be accomplished will assuredly benefit both parties to a transaction.

WHERE AND WHAT QUANTITY TO BUY

One of the first objects to be striven for is the avoidance of promiscuousness, either in canvassing the market for prices and quotations or in placing orders. The harmful results in wasted effort and loss of efficiency caused by sending out invitations to tender broadcast have already been pointed out. The remedy for this is a closer and better knowledge of sources of supply. Exact information can be accumulated and registered by the purchasing agent of all those concerns he is buying from or may buy from not only as to the nature of their product but also the quantities they are able to turn out in a stipulated time, whether they keep their promises, whether they are located geographically to serve the buyer to the best advantage, whether they are hampered financially or through lack of the requisite facilities to take care of his business.

The buyer need have no uncertain feeling in placing an order if he has the right information on file. The concerns he has asked to bid are the best in the country to serve him and give him best prices. He knows his order will receive proper attention, and any doubts as to its being executed in accordance with its terms and conditions are practically eliminated. He also has the satisfaction of knowing that this has been accomplished with the minimum amount of effort and expense to his own concern and also to those who catered for his business.

In these days of freight embargoes, geographical considerations are important. Those locations which admit of free movement of freight between the point of shipment and destination should be favored. It is not good policy at any time to be entirely dependent on one source of supply or on one transportation line. Strikes, breakdowns and other interruptions might seriously interfere with the delivery of the goods ordered and the economic ben-

efits of having placed an order advantageously be lost.

Buying the right quantity is just as important a feature as buying from the right supplier. It is just as poor policy to buy too much as too little. The reasons for this are obvious and it is only by scientific methods that the correct quantity can be ascertained.

The question of quantity is not always left to the decision of the purchasing agent, but he can always have a voice in deciding it. If for instance he has kept proper records, he can forecast with considerable accuracy the trend of market prices. On a declining market the proposition is fairly simple, but the reverse conditions involve questions of financing the purchases, storing the material until consumed or resold, if arrangements cannot be made to take shipments in quantities as required. Every buyer at times has offers made to him of larger quantities than he contemplates ordering at lower prices. If a ready market can be found, well and good, but if not, the actual price paid for the goods is not their true cost. To this price must be added cost of financing, storage, insurance, etc.

One cannot always buy for the future on the basis of consumption in the past, nevertheless records of the quantities consumed over a given period are extremely valuable in determining how much to buy. If the purchasing is being done for a factory making a well established and standardized product, it is almost as simple a proposition to specify future quantities required as to tabulate quantities consumed in the past. But in those factories where constant changes are taking place in the product and new articles being made it is sometimes exceedingly difficult to gage the quantities. In these cases the sales manager and production manager must be called into consultation and their views, combined with the purchasing agent's forecast as to prices, should determine the matter.

SPECIFICATIONS AND REPORTS ON MATERIALS

It is imperative that correct specifications be on file and accompany every order placed and every request for quotations. This specification may be only a few words or figures giving dimensions, but of whatever it consists, it must be worded in such a manner that no misconception can possibly exist as to the nature, quality and size of the material or article it covers. If this is strictly adhered to, it will be conducive toward the smooth, efficient and economic operation of the department and save time, expense and annoyance to the recipients. It also emphasizes the point already made that anything which can be done to save money for the seller eventually means a saving for the buyer. This feature is one to which closer attention could be paid by the great majority of buyers.

To determine that the material bought is actually being delivered, and to add to his knowledge of his purchases, a buyer should have reports regarding the quality of articles and materials. These reports may be made by inspectors appointed to test and inspect the material in process of fabrication in the supplier's factory or in the course of its progress through the buyer's factory.

There are also large numbers of small articles received into stores which must be checked and examined before placing them in the bins. Considerable variation is frequently seen in the products of manufacturers. Although apparently supplying the same article at the same price, one may be rougher in finish or not quite as accurate in size or carelessly packed. Reliable reports on all these points should be furnished to the purchasing department and

properly tabulated there in the information bureau. It is a debatable point whether the inspection of material purchased should be under the control or independent of both the purchasing agent and user of the material, but there is no question as to the advisability of the purchasing agent accumulating all the information possible regarding the material and articles he buys. This knowledge of materials is exceedingly useful to the buyer in those cases where substitutes are offered in place of the regular material. A decision can usually be given on the matter at once without reference to other departments and considerable time and trouble saved.

QUESTION OF PRICE NOT ALL IMPORTANT

A buyer goes into the market to purchase at the lowest possible price the particular grade or quality already determined as being most suitable for uses to which the material or article is to be put. If price is made the sole consideration in buying, and persisted in, it will have a tendency to force manufacturers to produce a cheaper product, and this policy has elements of danger. Price and quality must be considered together. They cannot be divorced in making a purchase. It is obvious that if the quality is not suitable for one's purpose the price is of minor or secondary importance. This question of quality applies to both higher and lower grades. A better quality might have constituents which to the user or in the manufacturing process might prove objectionable. It is essential, therefore, that the quality shall have been predetermined. The determination of quality is not always within the province of the purchasing agent, but it has to be definitely decided before he goes into the market.

Competition will help to settle the buyer's convictions that he is paying the right price, but, as already pointed out, this competition must be between those firms who are in the best position to supply one's needs. A record of prices paid in the past will serve as a guide together with the present condition of the market.

BUYING FOR THE FUTURE

Close observation of the tendency of the market will often prove extremely valuable in coming to a decision as to how far ahead of requirements purchases should be made. Good judgment in this connection will largely add to the profits of many concerns. This has been called scientific guessing, but it is far from that and is also entirely distinct from speculation. The greatest financial successes have been created through buying for future rather than immediate profits, and the element of risk is almost entirely eliminated when the purchasing agent knows he has an output for his purchases and has adequately informed himself regarding market conditions and prospects.

In buying ahead of requirements, shipments should be arranged on a schedule to conform closely to consumption demands, otherwise many additional features must be calculated and taken into consideration. If it means tying up money, the loss of interest must be computed, or if it means the occupation of additional storage space, the rental value must be estimated, also the larger insurance it may be necessary to carry. If the goods are liable to deterioration, this fact must not be overlooked.

CASH DISCOUNTS, TERMS AND CONDITIONS

In certain lines of goods and certain trades there are established rules and terms which are supposed to be strictly adhered to. Nevertheless, they are sometimes deviated from, and in other transactions where no fixed rules abound it is always open to the

buyer and seller to arrange terms. This is a powerful factor in determining the economy of a purchase and large use can be made of it in closing a negotiation. It is not the regular terms recognized and allowed in many lines of business that it is desired to call attention to. It is assumed that these can be obtained practically without asking, but where larger cash discounts can be secured or better terms arranged, substantial savings can be effected, and these are the cases on which emphasis is laid. Taking 30 days as the net time for payment, if the seller can be made to concede an extra half of 1 per cent for cash in 10 days, it means that he is willing to forego this percentage to obtain his money 20 days earlier, which is equivalent to over 9 per cent per annum; 1 per cent for the same period is just double this, and 2 per cent is over 30 per cent per annum. If the net time is 60 days, these percentages are 3.65, 7.30 and 14.60 respectively.

If his concern has to borrow money at 6 per cent to take advantage of these cash discounts, a buyer can figure out to what extent savings can be effected. It must not be overlooked, however, that the exact amount cannot always be borrowed for the exact time between the discount date and maturity date of an invoice, therefore, a certain amount of borrowed money will be idle, but not in sufficient amount to offset some of the advantages gained.

The time of the payment is also an important factor, particularly with those concerns working on a limited amount of capital, and in such cases a buyer can be of considerable value if he can arrange payments on long time, but if this has to be done at a sacrifice of price or cash discount, probably no saving will be effected. If facilities are available for borrowing money at the usual recognized commercial rates, it will generally be found that it is economically advantageous to do this and secure the cash discount rather than buy on extended time. It is of paramount importance to first secure the lowest price and then the longest time or the largest cash discount. Having obtained from the seller every possible concession in the matter of time and discount a review of the financial position of the buying concern will determine on which basis to close the transaction.

Transportation charges bear an important relation to the cost of some goods and must be given due consideration. To relieve his concern as much as possible, every purchasing agent should endeavor to make the seller pay transportation charges. If a price has been quoted f.o.b. point of shipment with freight allowed to destination, it means that the buyer has to provide finances for freight payments with the attendant clerical work of checking freight bills and having in force an infallible system by which these charges are debited to the seller.

If a buyer can arrange for all such shipments f.o.b. destination, freight prepaid, it means that he is securing for his concern very appreciable economic benefits. To go still further with this question of freight, it is possible in some cases to negotiate successfully with the seller for its prepayment even in those cases where the price has been agreed upon f.o.b. point of shipment, without any freight allowance. In these instances the buyer is getting the seller to carry his freight bills for him and the conditions mentioned in the last paragraph are reversed.

GETTING DELIVERY OF PURCHASES

If a purchase has been made on the most favorable basis as to all its terms and conditions and at the lowest obtainable price, all these economic benefits might be lost if the goods were not delivered on

time. It is imperative, therefore, due provision be made in the arrangement of the routing work of the buyer's office to follow these orders up and obtain shipment at the required time.

If the goods are bought for resale, the market for them might be lost in case of non-delivery, and if they are for manufacturing purposes a whole factory may be tied up or its work dislocated or hindered to such an extent as to involve heavy losses. In construction work a delay in receiving one item of material may entail serious consequences through the stoppage, not only of the particular work for which the material was needed, but other work which was contingent to it.

INVOICES AND PAYMENT

It is incumbent on the purchaser not only to buy and obtain delivery, but also to satisfy himself that the cash discounts, terms, conditions and other benefits he contracted for when closing the negotiation are positively secured. To insure this, it is essential that invoices be obtained from the seller in good time and that they are properly checked, approved and passed through his office for payment strictly in accordance with the terms of the agreement made at the time the order was placed.

A problem in connection with payments is when the point of shipment is at such a distance from destination that it is impossible to get delivery of the goods, properly check and examine them and approve the invoice in time to make the payment before the discount period expires. In these cases it is sometimes possible to obtain from the seller an extension of the time in which the discount is available or even to make this time date from arrival of goods at buyer's factory. When this cannot be done, the payment can be made in advance of the receipt and checking of the goods, but the purchaser must be doing business with reliable concerns whom he will have already selected by his process of elimination and selection already described.

Heat Losses in the Gas Engine

The distribution of the heat in gas-engine cylinders was the subject of a research made by Prof. A. H. Gibson and W. J. Walker at the engineering laboratories of University College, Dundee, Scotland, and described in a paper read before the Institution of Mechanical Engineers. The water jacket was divided into two parts, one covering the exhaust valve and that part of the cylinder containing the exhaust passage, while the other covered the cylinder barrel and the breech end. This arrangement enabled heat losses to be properly divided between jacket and exhaust losses. The research was made to ascertain the variation in heat distribution with variations in speed, brake horsepower, compression and the richness of the air-gas mixture.

The mechanical efficiency increased with increasing loads, diminished with increases of the air-gas ratio and speed, and was independent of the compression ratio, which varied between the limits of 5.17 and 6.62. The maximum efficiency was 88 per cent, obtained at full load with the richest (7:1) air-gas mixture, and at 150 r.p.m., the lowest speed. With the same mixture and at the normal speed of 200 r.p.m., the efficiency was 85 per cent. At normal speed and with an 11:1 mixture the efficiency was 76.7 per cent. The thermal efficiency increased with the load and compression ratio. Measured by the indicated horsepower, it increased slightly with an increase of speed, and reached a maximum with an air-gas mixture of 10:1. Measuring the thermal efficiency by the brake horsepower, the maximum was attained with an air-gas ratio of 8:1.

The percentage of exhaust losses diminished with increases of load and compression ratio, and slightly with increased air-gas ratio. They increased with the speed. The exhaust losses ranged from 33.6 per cent

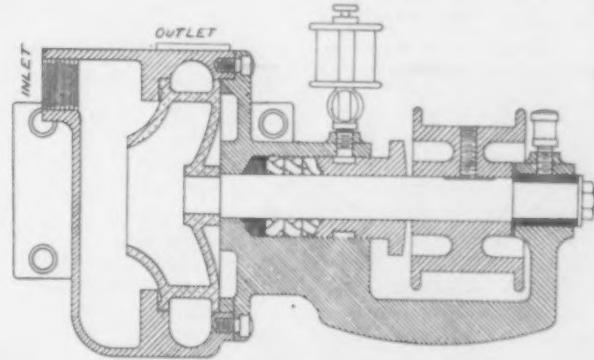
with a weak mixture, high compression and low speed to 42.5 per cent with a rich mixture, low compression and high speed.

The percentage of heat carried away by the jacket water, exclusive of the exhaust valve jacket, increased with the load, diminished with an increase of the air-gas ratio and the speed, and was independent of the compression ratio. With a 7:1 mixture at full load the percentage of heat transmitted to the jackets was 1.10 times as great at 150 r.p.m. as at 250 r.p.m. With an 11:1 mixture this ratio became 1.23. The rate of heat transmission through the cooling surfaces is more rapid at the highest speed.

The heat lost by radiation from the hot exposed surfaces of the piston and of the unjacketed portion of the breech, and from the outer surface of the jackets diminished as the load and speed increased, but increased with increases of the air-gas ratio, and slightly with increases in the compression ratio. At full load, radiation accounted for from 5 to 14 per cent of the heat delivered to the engine. The former value was obtained with a rich mixture, high speed and low compression ratio; the latter with a weak mixture low speed and high compression ratio. The percentage value of the heat entering the exhaust valve jacket ranged from 8.0 to 12.5. It is greatest at low loads, low speeds and with low compression ratios and rich mixtures. If this be added to the jacket loss it gives the jacket loss as determined by trials of an engine fitted with the ordinary jacket arrangement.

A Grinding Machine Circulating Pump

A substitute for the submerged fan type pump formerly used on the grinding machine has been brought out by the Cincinnati Lubricant Pump Company, Cin-



Sectional Elevation of a Centrifugal Circulating Pump for Grinding Machines

cinnati, Ohio. It is of the centrifugal type and one of the special features is the absence of bearings in the pump proper. It is also explained that the pump can be mounted above the level of the liquid being handled and will retain its prime without the aid of a check valve or other working parts on account of the positive trap arrangement forming a part of the design.

The outer shaft bearing is of phosphor bronze and takes care of the end thrust, while the inner bearing, which is cast iron, is combined with the stuffing box gland, a combination of metallic, graphite, rubber and flax packings being relied upon to guard this bearing against the entrance of emery, grit and dirt. Semi-automatic lubrication for both bearings is furnished from large oil reservoirs.

With a suction lift of 12 in. and a head lift of 4 ft. the pump will deliver 5 gal. per minute with a pulley speed of 1200 r.p.m. This flow can be increased to 15 gal. by causing the pulley to operate at 1600 r.p.m., and if a greater flow at this head lift or the same flow at a greater lift is desired, the speed of the pump pulley is augmented.

Recent statistics issued by the Japanese Government show that the number of vessels being built at Japanese shipyards is 99, with an aggregate tonnage of 439,470.

Recrystallization of Boiler Tubes*

Failure in Large Boiler Plant with Its High Evaporative Rate Held to Indicate Higher-Carbon Tubes Desirable

BY A. E. WHITE AND H. F. WOOD

AT a central steam boiler plant in Detroit where very heavy loads were carried for a number of weeks at a time, the metallographic examination of tubes showing incipient failure, revealed coarse crystals at the surface of the tube exposed to the high temperature. These failures also universally occurred in the front row of tubes where the temperature was highest and only on the side exposed to the flame. The question then naturally arose as to the conditions under which the coarse crystallization could have resulted. The effect of time, temperature and stress, therefore, on boiler-tube metal was accordingly investigated.

The object of the present research has been as follows:

To obtain a curve indicating the relation between the time and temperature governing crystal growth at temperatures below the critical range in a deformed low-carbon steel; and

To make a systematic study of the conditions existing where low-carbon steel is used at moderately high temperatures, after having been subjected to sufficient stress to result in permanent deformation, and to ascertain if the recrystallization phenomena, known to exist under such conditions, have any influence upon the possible failure of the metal.

To accomplish this, a steel of the following chemical composition was used:

Carbon	0.113 per cent
Manganese	0.479 per cent
Phosphorus	0.023 per cent
Sulphur	0.035 per cent
Silicon	0.023 per cent

EFFECT OF HEAVY RATINGS AND SCALE

Under normal ratings, the bagging of a tube at this particular central station seldom occurs, but when high rates of evaporation are maintained over long periods of time, trouble of a more or less aggravating nature is encountered. It is felt that the difficulty is due to heavy ratings combined with thin scale deposits.

The authors feel that the presence of a thin film of scale on the inside of a tube may so interfere with a rapid heat transmission that a tube may become locally overheated. The temperature to which the metal may arise will be well above that found in the tubes free from scale, and yet below the upper critical temperature of the metal. Such a temperature would in no way affect grain size in thoroughly annealed metal, but it may materially induce and produce grain growth in low-carbon steel previously deformed at temperatures below its critical point. This latter phase is the condition almost universally encountered in the boiler tubes used in present-day practice.

Under the best of refinements it is difficult to see how a tube perfectly free from strains can be obtained. Therefore, it is difficult to see how a tendency for coarse crystallization from such metal can be prevented. It is possible to make tubes with a higher carbon content, or possibly with the same carbon content as at present but containing a special element, such as nickel, which will not possess the same strong recrystallization tendency. These features merit consideration, and in fact, the first one is about to undergo a trial at one of the central heating stations in Detroit.

COARSE GRAINS AND PHYSICAL PROPERTIES

The extent to which coarse grains make low-carbon-steel boiler tubes weak and brittle, however, was determined by a number of tension and fatigue tests. Three sets of samples were employed; the first of untreated metal, the second of metal annealed for ten

minutes at 950 deg. C. and then cooled in the furnace, and the third of coarse-grain metal, produced by stressing all of the test specimens the same amount and in all cases past the elastic limit, and following this by an annealing for a period of three hours at a temperature of 800 deg. C.

The elastic limits and tensile strengths of the untreated samples averaged 34,420 lb. per square inch for the former and 54,450 lb. per square inch for the latter; while the values for the annealed samples were 21,700 lb. per square inch and 50,507 lb. per square inch, respectively. Such results showed that these samples had as good physical properties as could be expected from any metal of like composition and heat treatment. The elastic limit and the tensile strength of the coarse-grain samples averaged 14,117 and 39,633 lb. per square inch, respectively. These results were 58.2 and 43.1 per cent lower than were the results of the untreated samples, and proclaimed, therefore, a decidedly inferior grade of metal.

The actual stresses occurring in a boiler tube are tension and shear. If the principal stress resulting from a combination of the tension and shear becomes greater than the elastic limit of the metal, failure will take place. Since a coarse-grain metal has such an exceedingly low elastic limit, its use should be avoided when it is possible to get metal with a much higher elastic limit.

A very interesting development in connection with the tension tests is the fact that the percentage of elongation and the percentage of reduction of area remain practically constant throughout the entire series. This shows that the ductility of the metal is but little affected by the size of the crystals. It may therefore be said that coarse-grain ferrite is weak, but not brittle.

Fatigue tests were run on samples prepared in the same way as those for the tension tests. The coarse-grain metal was found to have an average resistance to fatigue 16.43 per cent lower than the untreated and 77.75 per cent lower than the annealed samples. This is very important when one considers that boiler tubes are constantly under the influence of alternating stresses.

GENERAL CONCLUSIONS

The many conditions studied and developed have resulted in the acquisition of a number of generalizations which, it is trusted, will prove to be of some value in certain connections. The six most important ones are summarized as follows:

1. The time-temperature relations for every fall of temperature of 25 deg. C., starting at 675 deg. C., governing the recrystallization of deformed low-carbon steel at temperatures below the A_1 critical point, follow the formula for geometrical progression, that is,

$$T = a, ar, ar^2, ar^3, \dots, ar^{n-1},$$

in which T represents time in minutes and a and r are equal to 8 and 3, respectively.

2. The etched surface of deformed low-carbon steel does not undergo the process of recrystallization when heated, even for long periods of time at temperatures below the critical point, although the metal immediately below the surface does show such change.

3. The recrystallization process on deformed low-carbon steel is an exceedingly rapid one at all temperatures below the A_3 point and above 700 deg. C. and between these limits recrystallization takes place in all cases in a fraction of a minute.

4. It is felt that perhaps the transformation occurring at 690 deg. C. has some effect upon the recrystallization process, since crystal growth took place at 700 deg. C. in a fraction of a minute and at 675 deg. C. in eight minutes. The present investigation has been insufficient, however, to warrant

*From a paper presented at the annual meeting of the American Society for Testing Materials at Atlantic City, June 28, 1916. Professor White is professor of chemical engineering at the University of Michigan, Ann Arbor, Mich.

any definite statement on the matter. It certainly offers a splendid opportunity for further work.

5. The evidence obtained during the present investigation seems to show that boiler tubes, if kept free from scale, will never fail because of the recrystallization of the ferrite crystals. A very thin layer of scale in the tubes, however, resulting in rise in temperature of the metal, may result in the recrystallization phenomenon.

6. Low-carbon steel in a deformed state is so stable at atmospheric temperatures that the time-temperature influence alone, at such temperatures, would probably require thousands of years for the production of crystal growth.

Alternating Current Driving in Factories

The types of alternating current motors best adopted to different classes of machinery, form the subject of a paper read before the Junior Institution of Engineers (Great Britain), by G. H. Ayres. The recommendations for the different types of machines are as follows:

Cranes.—For cranes a direct-current series-wound machine is recommended, but where alternating current only is available, a squirrel-cage motor should be used, which gives practically as good service as a direct-current machine and requires only half the number of trolley wires required by a slip-ring alternating current motor.

Fans.—For the driving of fans the slip-ring motor is desirable.

Machine Tools.—Large machine tools often require speed variation. It is usually preferable to use a constant-speed, squirrel-cage motor driving through a counter shaft by means of cone pulleys, or some other speed reduction gear. Slip-ring motors with resistance in the rotor circuit are entirely unsuited for this service. However, where a change-speed counter shaft is impractical a multi-speed motor designed for pole changing may be employed. Such motors can be made to give the same output at the lowest and highest speeds. This type of motor, however, possesses the disadvantage of being somewhat expensive.

Hydraulic Pumps.—Multi-speed motors are ideal for driving hydraulic pumps. Speed changes are made by a controller operated by the travel of the accumulator. The controller arrangements are considerably cheaper than is the case with direct current motors.

Line Shafts.—For workshops driven from line shafting, the separate machines being provided with tight and loose pulleys, the alternating current squirrel-cage motor is exceedingly convenient. It can remain permanently connected to the generator, and will run up to speed with the generator without excessive current consumption. An exciter rather larger than usual is necessary, but this method of starting is considered an excellent one by the author. When single phase current is supplied, the Arno-Ferraris starting system is recommended.

Pattern Making Machinery.—Motors usually ranging from 5 to 25 hp. are employed. As they start light, squirrel-cage machines with star-delta starters may be used. A duct should be placed under the floor extending from side to side of the room and open to the atmosphere outside of the building. Pipe-ventilated motors, drawing the air from this duct and discharging it through a gauze into the room, are the most suitable for pattern shops.

Foundry.—For the foundry, a short length of shafting can be used to drive rumbler, grinders, band saws and sand blast. The shafting should be driven by an open protected-type squirrel-cage motor. The motor must be cleared of dust by an air blast. Cupola blowers should be driven by slip-ring motors with regulating resistance in the rotor circuit.

Blowers.—Blowers and exhausters in blacksmith shops should be driven by high speed squirrel-cage motors with star-delta starters.

Forge and Structural Shops.—Drop hammers, shears and angle choppers may be driven by high speed squirrel-cage motors. A simple switch connecting the stator windings directly to the mains is sufficient for the control apparatus, the torque being ample to accelerate the flywheel within a reasonable time.

Hydraulic lifts, presses, etc., would be supplied by three-throw pumps driven by multi-speed motors as al-

ready described. The advantage of the multi-speed motor over the stop and start system is that it runs for longer periods at one speed and thus saves continual breaking of the circuit. Air compressors supplying air to pneumatic tools, must on account of the heavy torque needed, be driven by slip-ring motors.

Condenser to Be Made by Ingersoll-Rand Company

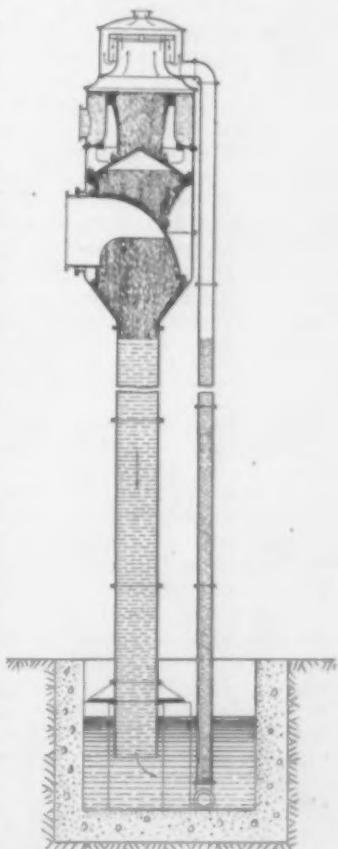
Patent rights to the Beyer barometric condenser have been secured by the Ingersoll-Rand Company, 11 Broadway, New York City. This condenser, which is of the counter-current type, enables the company to supply complete steam condensing plants for all service conditions.

In the condenser air and cooling water flow in opposite directions, the steam inlet being at the bottom of the condensing vessel, with the water inlet above and the air removal opening at the top. The water entering the condenser forms a pool that constantly overflows and then is brought into intimate contact with the entering steam by conical baffle plates. In this way, it is explained, the water absorbs the latent heat of the steam to its full capacity, the non-condensable air liberated in the action rising through the falling water to the opening at the top and being cooled in its passage to practically the temperature of the incoming water. The air entrained in the cooling water is removed before it mixes with the steam, which is relied upon not only to facilitate the mixing process but permits the removal of air and vapor at a comparatively low temperature, thus giving a reduced volume to be handled and effecting a saving in the amount of power required by the vacuum pump.

A large-diameter steam inlet is employed to give a low velocity and a hood is provided to cause the steam to be discharged into the center of the condensing vessel. The air removal opening, which also has a large area, is protected by a self-draining baffle and trap, which is relied upon to prevent water from being carried over into the vacuum pump. The hot waste water is discharged through a self-draining tail pipe which straddles the hot well and supports the condenser.

French Duty on Tool Steel

French customs officers, says *L'Usine*, of Paris, have been charging a duty of 15 francs per 100 kg., the regular duty on high-class steels, on ordinary steels, on the pretext that the value of common steels has risen above 50f. per 100 kg. The Minister of Finance has decided that during the war no steel is to be classed as high-grade steel for customs purposes unless its value is 75f. per 100 kg. or more, instead of 50f., as before. The journal quoted claims that the application of a duty of 15f. on common steels is contrary to law, as the customs tariff does not draw any free distinction, the quality only justifying the application of a higher duty.



The Ascending Steam and the Descending Water Are Brought into Intimate Contact by a Series of Conical Baffle Plates

CONDENSER TUBE TROUBLES*

Faults in Manufacture Which Have Caused Splitting in Service

BY A. E. WHITE

An investigation was conducted by the author in 1913 for the Edison Illuminating Company, Detroit, to: (1) account for the splitting of brass condenser tubes in service; (2) determine the proper chemical composition, mechanical treatment and heat treatment which should be given to the tubes; (3) formulate such specifications as would be of material service in the purchase of tubes. The specifications finally formulated completely eliminated the troubles previously encountered.

Chemical analyses were made to determine whether or not the splitting was due to the presence of such impurities as antimony, bismuth, iron, etc. The analyses showed the tubes to be of fairly uniform composition, and to be made on a basis 60 per cent copper and 40 per cent zinc, corresponding to Muntz metal. The percentage of impurities found was exceedingly low and these could not be held responsible for the tube failures. Subsequent investigations discovered the cause of splitting to be faulty manufacture. Specifically, the faults were excessive pinching during drawing, insufficient annealing between drawings or an omission of annealing or incomplete annealing after the final drawing.

CHEMICAL COMPOSITION

For fresh, unpolluted water the best composition is believed to be 70 per cent copper and 30 per cent zinc. For salt or polluted water an Admiralty mixture, 70 per cent copper, 29 per cent zinc and 1 per cent tin, is especially good, as are mixtures of 80 per cent copper, 20 per cent zinc, and 90 per cent copper, 10 per cent zinc respectively. For normal conditions, these latter three are expensive and may be disregarded.

The 70-30 mix is regarded as most desirable for the following reasons: (1) Such a proportion has the maximum ductility of all the brass compositions. See Fig. 1. (2) This mix gives a greater promise of adequate cold working and annealing. (3) The tube will have but one metallographic constituent, which will preclude the possibility of electrolytic action.

While a tube of 55 per cent copper and 45 per cent zinc has a greater tensile strength than one of the 70-30 composition, yet the greater ductility of the latter renders it superior for condenser use. Moreover, the tensile strength of the 70-30 tube is ample for the purpose for which it is used. In regard to working the tubes, the temptation is to work them hot as much as

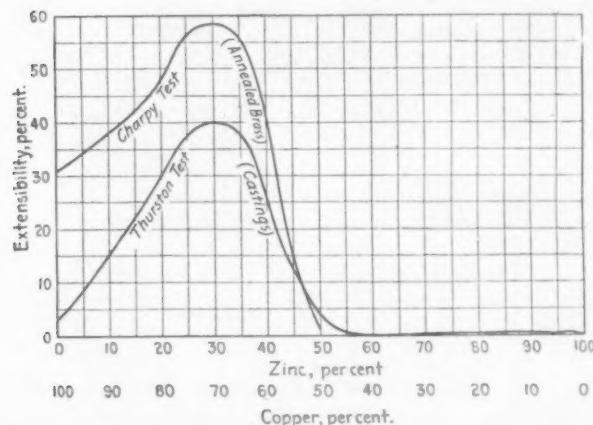


Fig. 1—The maximum ductility of copper-zinc alloys is found to be at a mixture of 70 per cent copper and 30 per cent zinc.

possible, this being less expensive than cold working. The very nature of the 70-30 metal precludes to some extent the tendency to hot working. Cold drawing,

*Abstract of a paper read at the annual meeting of the American Society for Testing Materials at Atlantic City, N. J., June 30. The author is professor of chemical engineering, University of Michigan, Ann Arbor, Mich.

when not too severe, assures a breaking down of existing crystallization, resulting in both smaller and better interlocked grains. It also makes necessary annealing between each set of cold drawings, both of which processes improve the quality of the tube. Too much cold drawing between annealings will distort the grain structure to such an extent as to produce heavy slip

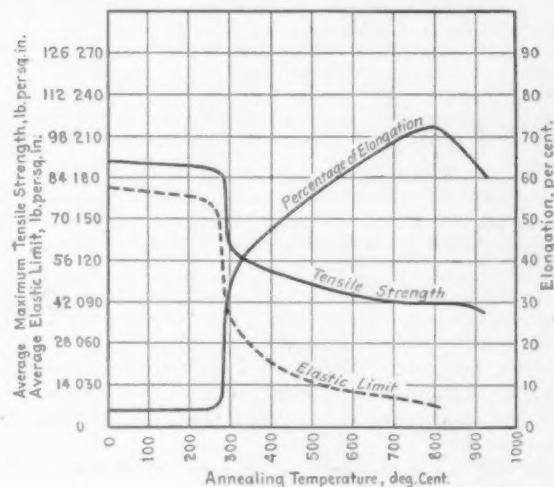


Fig. 2—The best condenser tube as regards its physical properties is the one that combines maximum ductility with maximum strength, indicated by the crossing of the curves representing those properties. The above is a record of the annealing tests of a tube of 67 per cent copper and 33 per cent zinc.

bands which are almost impossible to eliminate. It is more desirable to reduce the thickness of the tube by many light drafts than by a few heavy drafts. Not less than six drawings should be made, and twelve or even more cold drawings are to be preferred.

CHEMICAL IMPURITIES

The following impurities have a bad effect on the quality of condenser tubes. They should be limited as follows:

Lead.—If more than 0.1 per cent lead is present the ductility of the tube may be impaired. Lead is detected by the microscope, appearing as black dots scattered at irregular intervals over the surface.

Arsenic and Antimony.—Antimony tends to cause cracks in the metal containing it. It is advisable to keep the arsenic and antimony under 0.02 and 0.002 per cent respectively.

Bismuth.—The effect of bismuth is similar to that of antimony, although it is less injurious. It should be kept below 0.01 per cent.

Iron.—Iron will not have any appreciably harmful effect on the tube, providing it does not exceed 0.075 per cent.

HEAT TREATMENT

The heat treatment of condenser tubes should consist in annealing each tube between each cold drawing or set of cold drawings, at a temperature high enough to remove the grain distortion caused by the cold drawing, but not at such a temperature as will permit crystalline growth to take place to such an extent as to cause coarse crystallization. After the final drawing, each tube should be annealed just enough to break down the distorted structure produced by the last drawing. No specific temperatures can be given, as variations in the chemical composition and initial crystal size produce changes in the annealing temperature.

The correct annealing temperature of each composition should be ascertained by microscopic and physical test researches. Fig. 2 is a typical curve of such a research. The best annealing temperature is probably that at which the curve of tensile strength crosses that of percentage of elongation. The length of time the tube is held at the annealing temperature is also of importance. A Muntz metal tube of 60 per cent copper and 40 per cent zinc gave a maximum ductility when heated seven hours at between 560 and 690 deg. C.,

while the same metal annealed for one-half hour at 750 deg. C. also attained maximum ductility. These temperatures are too high for commercial work as they produce an unnecessarily large grain. When tubes are heated to, but not held at, a given temperature and cooled at different rates, the metal which cooled the slowest lost its original structure the earliest and produced coarse crystallization the quickest.

SPECIFICATIONS

As a result of the investigation a set of specifications for condenser tubes was prepared. These conform somewhat closely to the U. S. Navy Department specifications but have had added a provision for micro-structure examination.

A Theory of the Corrosion of Steel

Two theories have been advanced to account for the actual corrosion of iron, says Leslie Aitchison of Sheffield, England, in a paper "The Theory of the Corrosion of Steel," presented at the annual meeting of Iron and Steel Institute in London, May 4, 1916. In a large number of experiments the material employed has been pure, or nearly pure, iron, and in most cases the interest has centered around the attack upon this of pure water. At the present time the question is an open one as to the actual details of the corrosion under these conditions. Most workers have left the theory of the corrosion of steel, which is a material of much greater complexity of structure than iron, rather well alone.

The complex structure of steels, composed as they are almost invariably of carbides embedded in a matrix of some carbon-free materials, renders it almost certain that the action going on in a steel during its corrosion is a galvanic one. The large number of galvanic couples present in an ordinary sample of steel can be well imagined, and these couples will consist of the carbide on the one hand and the ferrite or solid solution on the other. This postulates at once that one of the two constituents will be anodic in its action and the other cathodic.

The intensity of the galvanic action between the two constituents will depend, other things being equal, upon the potential difference between the two constituents with respect to the corrosive liquid which is in contact with the steel. The carbides in all steels, although of varying chemical composition, will be likely to be possessed of very similar electrical properties, and hence it appears reasonable to assume that the electrolytic solution pressure of all the carbides will be the same, or nearly so.

On the other hand, the solid solution, which may range from practically pure iron to an alloy containing many percentages of a second element, will be a material of very varying electrical properties. As a result the electrolytic solution pressure of this constituent will change very considerably from steel to steel, and will in consequence produce a considerable variation in the potential difference existing between the constituents of the steel. Thus the corrosion of the steel should vary a great deal with changes of composition.

The three pieces of evidence—the microscopic, the analytical by sulphuric acid, and the effect upon the corrosion—may be taken as conclusive in proving that the carbides act throughout as cathodes. The rest of the material then becomes the anode in the various galvanic couples present in the material. This residue of the steel is practically always solid solution. In the case of ferrite the solution is extremely dilute, sufficiently so for the ferrite to be termed pure iron, while in other cases there may be as much as 12 or 15 per cent of a second element.

The author drew the following conclusions:

That the corrosion of a steel takes place purely by the action of the ferrite or the solid solution.

That the action upon pure ferrite may be due entirely to the potential difference set up in consequence of the different solution pressures of the grains of the metal and the inter-granular cement, it being probable that this latter is possessed of a greater electromotive force.

That the percentage of the third element added to

iron and carbon in steels must be sufficiently great to produce a fairly high percentage in the solid solution, if there is to be any beneficial effect from the use of this element.

That the electromotive force of the solid solution with respect to the corrosive liquid is the deciding factor in the corrosion of a steel.

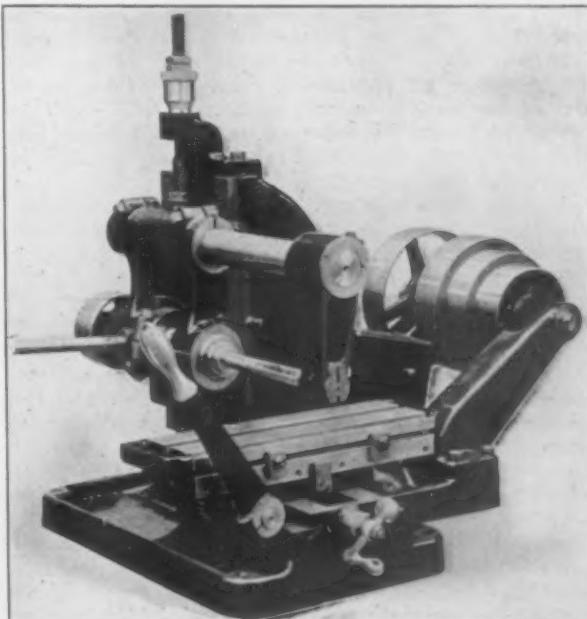
That the pearlite in a steel does not corrode as a whole, but as a mixture of ferrite and cementite, the disappearance of the latter being due to mechanical and not to chemical action.

That carbides are not decomposed by ordinary corrosive agents, and that they act merely as cathodes to the anode of the ferrite or solid solution.

Adjustable-Head Bench Milling Machine

A bench milling machine in which the head is moved up and down the column by a rack and segment has been placed on the market by the Morris Machine Tool Company, Cincinnati, Ohio. A micrometer depth gage is also furnished for the head and if desired the whole machine can be supplied mounted on a pedestal.

The rack and segment arrangement which provides for a vertical adjustment of 5 in. is operated by a lever that can be placed in two positions to suit the convenience of the operator. A counterbalance weight is furnished for the head and can be adjusted to take care of different sizes of cutters or arbors, thus it is emphasized giving an accurate balance for the head. The spindle, which has a No. 7 Brown & Sharpe taper, runs in bronze bearings, the front one being of the



A New Bench Milling Machine in Which the Head Is Moved Through Its Vertical Travel of 5 In. by a Lever-Operated Rack and Segment

taper type and having an adjustment to take care of wear. Bronze bearings are also furnished for the back shaft and all bearings are lubricated by a capillary oiling system. A three-step cone pulley receives power from a countershaft, and by reversing the pulleys on the ends of the spindle and the back shaft it is possible to secure six speeds ranging from 120 to 1080 r.p.m. with a countershaft speed of 360 r.p.m.

The table measures 4 x 15 in. and has a feed of 6 in. A lever operating through a rack and pinion provides the traverse for the table. A square thread screw with micrometer adjustment is employed to feed the saddle in or out.

The Merchants' and Manufacturers' Association of Milwaukee, Wis., and the Milwaukee Real Estate Association have joined in a plan to organize a stock corporation to loan money on good security to needy industries of merit.

American Society for Testing Materials

New and Amended Steel Specifications—Heat Treatment of Axles, and Boiler Tubes, Condenser Tubes and Elastic Limit Discussed

SPECIFICATION making again stands out as a prominent achievement of the American Society for Testing Materials. The annual meeting of the society was held at Atlantic City, N. J., last week, and while consideration of specifications as well as of methods of testing occupied only a part of the time, the society did enough to add measurably to its prestige as a national engineering organization which is particularly active in consummating things of immediate practical value. As has been the case in late years, differences between consumers and producers were ironed out in committee gatherings prior to the meeting, at least so far as iron and steel matters are concerned, and the meeting devoted itself to ratification of the committee recommendations. Thus the changes and new specifications approved, as noted below, are substantially now in force, the formality of a mail ballot of the membership alone being necessary; unless the experience in this regard is upset, which would be for the first time, the action of the meeting will be upheld by a substantial preponderance of the voters by mail.

In the field of iron and steel, chief discussion occurred over the hunt for the elusive elastic limit, over the quenching of axles in oil or water and over the possibilities that higher-carbon boiler tubes are a necessity with the modern high rates of evaporation in large steam boiler plants. In the non-ferrous field, brass condenser tubes, the uses and grades of spelter and a review of the tin situation preliminary to drafting a specification received chief consideration. Tests for refractory firebrick were discussed at length, but the topic over which there was something of the old-time controversy was cement.

Sessions were held beginning Tuesday, June 27, and continued through June 30. The leading points of the first day's sessions were noted in last week's issue, including the plan to bring out new and amended specifications only every even-numbered year, that is, biennially; and the very definite added influence given to the A. S. T. M. specifications by the U. S. Department of Commerce by its translating them into foreign languages and distributing them through United States consular offices. In spite of simultaneous meetings of national engineering societies elsewhere—of civil engineers in Pittsburgh and electrical engineers in Cleveland—the attendance exceeded the record of last year. Subjoined is a detailed statement of what the committee on steel has done in the past year, under the chairmanship of C. D. Young, engineer of tests of the Pennsylvania Railroad, and a necessarily brief report of the sessions on iron and steel, on tests and testing, on non-ferrous materials and on cast iron, coke, etc.

THE WORK OF COMMITTEES

Prof. Mansfield Merriman, in his address as president, devoted himself to the work of the society's committees. He paid a tribute to William R. Webster, who was long chairman of the committee on steel and who "introduced indeed those principles and methods which have formed the basis of all work subsequently done." The specifications issued by the society differ materially from those of the International Association, he pointed out, in that they are complete for the use of both producers and consumers, instead of relating mainly to methods of testing. It must be confessed, he continued, that this practice has caused the original aim of the International Association—to establish standard methods of testing—to be lost sight of to a considerable extent and it seems desirable that further work in this direction should be done.

The real work of a large committee, he agreed, is usually done by a few of its members and about twelve is the number which generally produces the most sat-

isfactory results. The society has now actively at work 37 committees, and 15 of these have 89 sub-committees. These are classified under five groups: A, designating iron and steel; B, non-ferrous metals; C, cement and concrete; D, miscellaneous materials, and E, miscellaneous subjects. The largest committee is A-1, which has 97 members. Group A has 8 committees, 255 members and 25 sub-committees. Altogether the membership of the 37 committees is 913, which is nearly one-half the membership of the society, but since some men are on two or more committees it is probable that only about one-third of the members are engaged in committee work.

At the time of the issue of the last list, there was a total membership of 1902, of which about 16 per cent were firms and corporations. But on the rolls of committees the percentage is much higher, it being, for instance, 51 per cent in the large committee A-1. Since companies usually defray the expenses of their representatives to committee meetings, it appears that their attendance is better than that of individual members, and that thus the influence of firms and corporations is greater than that of individuals. No objection can be made to this, for companies, whether they be producers or consumers, are working not only for themselves but for their customers.

It is undoubtedly due to corporations and firms that the committee work of the society is conducted so cheaply. Owing to the large volume of their trade it is necessary for companies to make numerous tests and to carry on considerable research, the results of which are freely communicated to committees by their representatives. During the period of two years from Jan. 1, 1914, to Dec. 31, 1915, the total expenses of all technical committees, including joint conferences, were \$2,440.16, which is nearly 5 per cent of the total disbursements for all expenses of the society during the same period.

Report of the Committee on Steel

The report of the committee on steel, A-1, summarized briefly the rail situation as it stands to-day; announced the organization of a sub-committee to prepare specifications for carbon tool steel; offered revisions to seventeen existing specifications; proposed six new specifications; made a number of miscellaneous recommendations, and promised that in the ensuing year specifications for steel tires will be studied, that the variation in weight and thickness of sheared plates for ship use and of thin plates and sheets as for electrical work, metal furniture and passenger car trim will be investigated, and that the order and manner of reporting various physical properties of steel and the method of describing the character of fracture will be taken under consideration. The report, comprising in all 123 pages, indicated that a tremendous amount of work had been done in the year, and all the recommendations of the committee were approved.

The review of the rail situation points out that two ideas predominate as to what needs to be done: one is the elimination of the failures which are commonly associated with segregation, and the other the elimination of the failure by transverse fissure. The report says:

SEGREGATION IN RAILS

There seems to be a fairly well-crystallized opinion that split heads and mashed heads are generally associated with segregation, and a number of tests have been proposed which will permit the easy detection of this condition. Those most commonly known are:

Estimation of Segregation by Means of Chemical Analysis of Center and Outside of the Rail.—The objection to this test

is the most involved and the equipment required. The facilities which have been found necessary by the large railroad which has used this method are probably beyond the reach of many smaller railroads. The results, however, are definite, are not to any great extent functions of the personal equation of an inspector, and the service in track of rails which were purchased subject to this method of testing are exceptionally good, the rails being practically free from failures after a considerable period of service.

Estimation of Segregation by the Appearance of the Transversely Fractured Section of the Rail.—The estimation of segregation from the appearance of the fracture is claimed to be much affected by the personal equation of the individual, and is not of such a positive character as to permit of any absolute check in case of disagreement between the manufacturer and the inspector. It is further claimed that the results obtained in some experiments, made to corroborate and correlate the results of judgment based on appearance of fracture with chemical analyses made on drillings taken from the fractured piece, showed that while in some cases the judgment based on the fracture was corroborated by analysis, in many cases it was contradicted.

Estimation of Segregation by Means of Brinell Hardness Tests Made at Center and Outside of a Transverse Section of the Rail.—Experiments have been made to determine whether segregation in rails can be detected by Brinell hardness tests at center and outside of a transverse section, checking the hardness readings by chemical analyses. The results obtained were not of a character to give much hope that this method would be of practical value.

TRANSVERSE FISSURES IN RAILS

This type of failure, which has come into prominence in the last few years, is not so clearly understood as the other principal types which have been under observation for a longer period. Various theories have been advanced as to the causes of this type of failure, varying from included foreign matter in combination with high chemical hardeners and internal stresses to possible checks from cooling or from cold straightening. Although the initial cause at the start of the fracture is unknown, it is generally agreed that the development of the fracture up to the point of final breakdown of the section is due to repeated loading, causing deflection, upon the rail in track. On the other hand, some engineers attribute this type of failure to the action of heavy wheel loads and the stress produced in the rail by the cold rolling of the surface under traffic in combination with some unknown condition in the steel. No definite proof has been offered as to the absolute cause for this type of failure and, therefore, the means of correction are not at hand.

In general, the research which is being done upon rail steel is being carried forward in such a manner as to justify hope for the future. Both manufacturers and consumers are active in endeavoring to improve the quality of the steel in order to eliminate the failures, and are working out the problem in thorough cooperation.

PERMISSIBLE VARIATIONS IN PLATES

The revision in existing standards included steel plates in six structural steel specifications. A table was drawn up for the permissible variations when plates are ordered by weight and a new table of permissible overweight of plates ordered to thickness. These are here reproduced, and, it is understood, will be formally adopted by the Association of American Steel Manufacturers.

In the society's specifications on track bolts the following supplementary requirement has been added: "The length of the bolt under the head shall not vary more than $\frac{1}{8}$ in. from that specified."

In the specification on structural steel for cars it is hereafter provided that the tensile strength of rivet steel may range from 45,000 to 60,000 lb. per square inch, instead of 48,000 to 58,000 lb., the present requirement.

CHANGES IN FORGING SPECIFICATIONS

In respect to steel forgings, the committee's recommendation of the method of determining the elastic limit of heat-treated or cold-rolled steels is in brief as follows:

Table I—Permissible Variations of Plates Ordered to Weight

ORDERED WEIGHT, LB. PER SQ. FT.	PERMISSIBLE VARIATIONS IN AVERAGE WEIGHTS PER SQUARE FOOT OF PLATES FOR WIDTHS GIVEN, EXPRESSED IN PERCENTAGES OF ORDERED WEIGHTS															
	Under 48 in.		48 to 60 in. excl.		60 to 72 in. excl.		72 to 84 in. excl.		84 to 96 in. excl.		96 to 108 in. excl.		108 to 120 in. excl.		120 to 132 in. excl.	
	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under		
Under 5	5	3	5.5	3	6	3	7	3	...	...	...	...	...	...
5 to 7.5 excl.	4.5	3	5	3	5.5	3	6	3	...	...	...	...	...	...
7.5 " 10 "	4	3	4.5	3	5	3	5.5	3	6	3	7	3	8	3		
10 " 12.5 "	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	7	3		
12.5 " 15 "	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	7	3		
15 " 17.5 "	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3		
17.5 " 20 "	2.5	2	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5.5	3		
20 " 25 "	2	2	2.5	2	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3		
25 " 30 "	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	2	4.5	3		
30 " 40 "	2	2	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	2		
40 or over	2	2	2	2	2	2	2	2	2.5	2	2.5	2.5	3	4		

Note.—The weight per square foot of individual plates shall not vary from the ordered weight by more than one and one-half times the amount given in this table.

The elastic limit called for by these specifications shall be determined by an extensometer reading to 0.0002 in. The extensometer shall be attached to the specimen at the gage marks and not to the shoulders of the specimen nor to any part of the testing machine. The observer shall watch the elongation of the specimen as shown by the extensometer and shall note, for this determination, the load at which the rate of elongation shows a sudden increase.

Where requirements involve the determination of the crystalline nature of the fracture, "the fracture shall be considered crystalline if the crystals which it contains are so large that the cleavage planes or sides of these crystals are easily visible to the eye."

As regards drop test requirements of car and tender axles, the committee is cooperating with the Master Car Builders' Association, involving a proposal to use a 2240-lb. tup instead of a 1640-lb. tup, as at present.

The collars of quenched and tempered axles and other forgings must hereafter be rough turned, instead of being left rough forged.

In rolled wheels for railroad service, the requirement as to rotundity has been changed so that the opening between the tread and the ring gage shall not exceed 1/16 in. instead of 1/32 in.

The three classes of steel tires hereafter have carbon content requirements as follows: Class A, passenger locomotive driving tires, 0.50 to 0.70 per cent; Class B, for freight locomotives and cars, 0.60 to 0.80 per cent; Class C, for switching locomotives, 0.70 to 0.85 per cent. The drop test has been omitted.

SPECIFICATIONS RELATING TO BOILER STEEL

The steel boiler tube specifications have been extended to include tests for superheater pipes and the

Table II—Permissible Overweights of Plates Ordered to Thickness

ORDERED THICKNESS, IN.	PERMISSIBLE EXCESS IN AVERAGE WEIGHTS PER SQUARE FOOT OF PLATES FOR WIDTHS GIVEN, EXPRESSED IN PERCENTAGES OF NOMINAL WEIGHTS.													
	Under 48 in.		48 to 60 in. excl.		60 to 72 in. excl.		72 to 84 in. excl.		84 to 96 in. excl.		96 to 108 in. excl.		108 to 120 in. excl.	
Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under
Under 1/8	0	10	13	14	...	...	...	...	...	...	...	...	...	...
1/8 to 3/16 excl.	8	9	10	13	...	...	...	...	...	...	...	...	...	...
3/16 " 1/4 "	7	8	9	10	13	...	...	...	...	...	...	...	...	...
1/4 " 5/16 "	6	7	8	9	10	13	...	...	...	...	...	...	...	...
5/16 " 3/8 "	5	6	7	8	9	10	13	...	...	...	...	...	...	...
3/8 " 7/16 "	4.5	5	6	7	8	9	10	13	...	...	...	...	...	...
7/16 " 1/2 "	4	4.5	5	6	7	8	9	10	13	...	...	...	...	...
1/2 " 4/9 "	3.5	4	4.5	5	6	7	8	9	10	13	...	...	...	...
4/9 " 5/14 "	3	3.5	4	4.5	5	6	7	8	9	10	13	...	...	...
5 " 1 "	2.5	3	3.5	4	4.5	5	6	7	8	9	10	13	...	...
1 or over	2.5	2.5	3	3.5	4	4.5	5	6	7	8	9	10	13	...

table of standard weights has been changed. A new diameter, $1\frac{1}{8}$ in., has been added and two new thicknesses of pipe wall, and the weights are given in three decimal places. The table is here reproduced, together with a table for small superheater pipes, which is new.

In the specifications for boiler and firebox steel, besides the tables of permissible weight and thickness variations already referred to, it is also required that hereafter the tension test specimen is to be taken longitudinally from the bottom and the bend test specimen transversely from the middle of the top of the finished rolled material. In present practice both are taken longitudinally from the bottom. The bend test specimen is to be tested cold only, omitting the quench-bend test, and the requirements as to cold bend are now that the specimen for material 1 in. or under in thickness shall bend around a pin, the diameter of which is equal to the thickness of the specimen; and for material over 1 in. in thickness, around a pin the diameter of which is equal to twice the thickness of the specimen.

specimens, cold bending and the match marking, and also in allowing 55,000 to 65,000 lb. per square inch tensile strength of firebox steel, while the boiler code specifies 55,000 to 63,000 lb.

ORDER OF REPORTING CHEMICAL COMPOSITION OF STEEL

The committee has adopted and recommends the following order for reporting chemical composition of steel: Carbon, manganese, phosphorus, sulphur, silicon, copper, nickel, and chromium. It further recommends that percentages of carbon, manganese and silicon be reported to two decimal places and percentages of phosphorus and sulphur to three decimal places. The committee has requested the cooperation of the Association of American Steel Manufacturers in extending the use of these practices.

METHODS FOR PHYSICAL TESTS

The question of standard holders for 2-in. tension

Weights of Lap-Welded and Seamless Steel Boiler Tubes, Including Safe Ends, Arch Tubes and Large Boiler Plates															
Thickness—		Weight, Pounds Per Feet of Length													
Nearest In. B. w. g. or Fraction		1 $\frac{1}{8}$	1 $\frac{1}{4}$	2	2 $\frac{1}{4}$	2 $\frac{1}{2}$	3	3 $\frac{1}{2}$	4	4 $\frac{1}{2}$	5	5 $\frac{1}{4}$	5 $\frac{3}{8}$	5 $\frac{1}{2}$	6
0.095	13	1.679	1.806	1.932	2.186	2.440	...	...	...	...	...	...	...	...
0.110	12	1.926	2.073	2.220	2.514	2.807	3.395	...	...	...	...	...	...	...
0.125	11	2.169	2.336	2.503	2.836	3.170	3.833	4.505	...	...	...	...	...	...
0.135	10	2.328	2.508	2.688	3.049	3.409	4.130	4.851	5.572	...	...	...	...	...
0.150	9	2.560	...	2.960	3.360	3.760	4.565	5.366	6.167	6.968	7.769	8.170	8.370	8.570	9.370
0.156	5/32	4.748	5.579	6.414	7.248	8.083	8.500	8.708	8.917	...
0.165	8	4.110	4.995	5.877	6.758	7.639	8.520	8.960	9.181	9.401	10.282
0.180	7	4.460	5.421	6.382	7.343	8.304	9.266	9.746	9.987	10.227	11.188
0.187	3/16	...	...	...	...	5.632	6.633	7.634	8.635	9.637	10.137	10.388	10.638	11.639
Small Superheater Pipes—Seamless Only															
Thickness—		Weight, Pound Per Foot of Length													
Nearest In. B. w. g. or Fraction		%	11/16	%	13/16	%	15/16	1	1 $\frac{1}{4}$	1 $\frac{1}{8}$	1 7/16	1 $\frac{1}{2}$	1 $\frac{1}{8}$		
0.095	13	0.5375	0.6012	...	0.7462	0.8190	...	...	...	...	...	...	...	...
0.109	12	...	...	...	...	...	0.9676	1.0480	1.280	...	...	...	...	...
0.120	11	...	...	...	...	...	...	...	...	...	...	...	...	...
0.135	10	...	...	...	...	...	...	...	...	...	...	...	...	...
0.150	9	...	...	...	...	...	...	...	...	...	...	...	...	...
0.156	5/32	...	...	...	...	...	...	...	...	...	...	...	...	...

Match marking of test coupons has also been provided for as follows:

"(b) When specified on the order, plates shall be match marked as defined in Paragraph (c), so that test specimens representing them may be identified. When more than one plate is sheared from a single slab or ingot, each shall be match marked so that they may all be identified with the test specimen representing them.

"(c) Each match mark shall consist of two overlapping circles each not less than $1\frac{1}{8}$ in. in diameter, placed upon the shear lines, made by separate impressions of a single-circle steel die.

"(d) Match-marked coupons shall match with the sheets represented and only those which match properly shall be accepted."

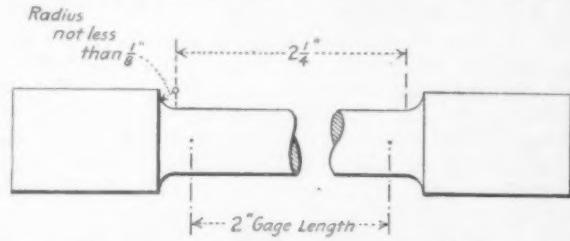
NEW AND PROPOSED SPECIFICATIONS

Seven steel specifications which have been in existence one year as tentative specifications were approved and ordered submitted to the membership for a mail ballot. These cover springs and alloy-steel forgings. The committee reported it was not yet ready to report on the requirements as to permissible variations in dimensions of bars for railroad and automobile springs. The six new specifications are as follows:

- For steel track spikes.
- For steel screw spikes.
- For steel tie plates.
- For carbon-steel bars for railway springs with special silicon requirements.
- For elliptical springs for automobiles.
- For boiler and firebox steel for stationary service.

The specifications on elliptical springs for automobiles are virtually the same as those of the Society of Automobile Engineers, with which society the committee is co-operating, while that on boiler and firebox steel for stationary service is a result of revising the specification for boiler and firebox steel already referred to to agree with the boiler code of the American Society of Mechanical Engineers. It differs from that in the new provisions covering the selection of test

test specimens was considered. The Panama Canal Commission pointed out that in many laboratories special holders for 2-in. tension test specimens for steel castings were in use which did not require threading of the ends and which seemed to give entirely satisfactory service. The committee accordingly recommended that tension test specimens shall conform to



Tension Piece Need Not Have Threaded Ends

the dimensions shown in the accompanying illustration. The ends shall be of a form to fit the holders of the testing machine in such a way that the load shall be axial.

TENSION TESTS IN 150 SECONDS

Following the presentation of the report of the committee on steel, some motion pictures of testing at the Altoona laboratories of the Pennsylvania Railroad were shown. One of these indicated remarkable speed in making complete tension tests. The total time was 150 sec.; of this 35 sec. sufficed for getting the elongation and 55 sec. for determining the breaking load, leaving the remainder for such details as inserting the specimen in the machine, attaching and removing the extensometer, etc.

HEAT TREATMENT OF AXLES

A paper by C. D. Young on the heat treatment of carbon-steel locomotive axles was offered by the author

(Continued on page 64)

American Car & Foundry Report

The seventeenth annual report of the American Car & Foundry Company, covering operations for the fiscal year ended April 30, 1916, is an interesting document, as it dissipates the extravagant expectations of huge profits accruing from war orders. President W. H. Woodin says:

"The net earnings of the company for the fiscal year amounted to \$2,816,017.55—this being \$485,081.47 in excess of the net earnings for the preceding year. From these net earnings there has been paid the regular dividend of 7 per cent (\$2,100,000) on the preferred stock and a dividend of 2 per cent (\$600,000) on the common stock, and the remaining \$116,017.55 has been added to the company's surplus.

"Repeatedly throughout the year reports were current of the letting of contracts for the production of enormous quantities of munitions of war of various kinds, with extravagant estimates of accruing profits. Many of such reports were gross exaggerations, and many were without any foundation. That the exact facts so far as concerned your company might be known, your president caused to be publicly stated the precise figures (approximately \$7,300,000) of all such contracts undertaken by it.

"Your company has not ventured rashly upon this field of industrial effort. The problems presented in connection with such contracts were, as matter of actual experience, in large measure new. These problems, and the general conditions attendant upon this class of work, were made the subject of most careful study. The contracts have been taken at prices that may reasonably be expected to yield a fair margin of profit. While the work has not been without its difficulties, it has progressed satisfactorily. Up to the close of your company's fiscal year, the deliveries made under these contracts were inconsiderable in amount, and in consequence no profits from this work are included in the report. At no time, however, have your officers lost sight of the fact that this class of business is in its nature transitory; and there has been no impairment of the capacity of your company to meet promptly and efficiently all demands that may be made upon it by the requirements of peaceful commerce.

"The generally prosperous condition of the oil industry of the country during the year stimulated the demand for tank cars. The demand for this class of equipment comes not only from the railroads but also, and in larger measure, from the concerns whose immediate business is the production and distribution of the commodity, and to whom the ownership of vehicles of transportation is essential.

"The needs of the railroads with respect to additional equipment were substantially as great at the close as they were at the beginning of the year. There was in evidence throughout the year a desire on the part of the roads to supply by purchase some part at least of the additional equipment required to handle properly the traffic of the country, and there was buying in larger volume than during the preceding year. The need for steel and steel products of all kinds to meet the requirements both of foreign demand and of domestic industries has been most urgent, and beyond the capacity of the mills to meet promptly, and the resulting advance in the cost of material and the difficulty in procuring reasonably prompt deliveries have affected adversely the tendency of the railroads toward increased buying. It is to be expected that in time the steel industry will be able to adjust its facilities to meet demand.

"It is worthy of note that of the cars to be built by your company there are some of wooden construction. For cars of this type there have been placed but few orders during recent years—although they have some advantages in the line of economy over steel cars for certain classes of service. They have, under existing conditions, the great advantage that they can be more quickly delivered than can steel cars. While your company has of recent years enlarged its capacity for the construction of steel cars to keep pace with the constantly increasing demand for cars of that type, it has at no time lessened its capacity for the production of cars wholly or partly of wood; and hence it is in

position adequately to care for all equipment orders, whether the cars required be of steel or of wood, or partly of steel and partly of wood.

"For the reasons already discussed, the orders for new equipment have not been as great as they undoubtedly would have been had conditions been otherwise. Your board is nevertheless able to report that the number of car orders on the books was considerably larger at the close than it was at the beginning of the year. There has been during the year a considerable foreign demand for equipment. Your company's export department has been thoroughly organized, and has obtained a fair share of such orders."

MESABA STRIKE WANING

Ore Shipments Keep Up Well—Dock Workers Refuse to Go Out

DULUTH, MINN., July 5.—*By Telegraph.*—The Mesaba range strike situation stands about where it did a week ago. A few men have returned to work in Virginia, but about 400 have gone on strike at Nashwauck. The efforts made to organize the dock workers in this city and Two Harbors were without avail and the leaders who were at work in the two cities have departed for the range. The Duluth officers would not tolerate the I. W. W. methods and informed the agitators that they would have to leave.

Ore shipments are going on steadily, with little falling off in tonnage. The open pit mines that are operating are doing everything possible to get out all of the ore that they can in order to make up for the underground mines that cannot ship.

A deputy sheriff and an innocent bystander lost their lives Monday afternoon when a party of deputy sheriffs went to serve warrants on striking miners who were lodged in a house in Biwabik. The strikers opened fire before the deputies had reached the house and James C. Myron, prominent in Duluth, was killed instantly. All of the strikers were arrested later and charged with murder. Four killings have occurred since the trouble started a month ago. Public opinion is now strongly against the I. W. W. and the strikers. The officers have received orders to stop all intimidation and protect all men who desire to work. The three principal leaders of the I. W. W. who went to the range have been arrested and brought here. They are charged with inciting riots and will be held without bail. From the present outlook it is not believed that the strike can continue much longer.

Mine operators believe the crisis is past. There has been no further spread of the strike and some of the strikers show a disposition to return to work. It is estimated that the curtailment in production since the strike was inaugurated has been less than 20 per cent. Shipments in July will be affected, however, for the reason that even if the strike is entirely broken the return of men is expected to be gradual, and some have left the region.

Steel Corporation Improvements and New Work

The United States Steel Corporation's plans for construction work at Ojibway, Ontario, look to the putting forward of dock and other preliminary construction this year and it is probable steel works construction will not be undertaken on any considerable scale before 1917.

A considerable extension of the iron and steel foundries of the Gary, Ind., works of the Indiana Steel Company has been authorized.

The plate mill at the Shoenberger works of the American Steel & Wire Company has long been inoperative. The improvements recently under way will probably be completed so that it can be started up by the middle of August.

ESTABLISHED 1855

THE IRON AGE

EDITORS:

GEO. W. COPE

A. I. FINDLEY

W. W. MACON

CHARLES S. BAUR, *Advertising Manager*

Published Every Thursday by the DAVID WILLIAMS CO., 239 West Thirty-ninth Street, New York

W. H. Taylor, *Pres. and Treas.*

Charles G. Phillips, *Vice-Pres.*

Fritz J. Frank, *Secretary*

M. C. Robbins, *Gen. Mgr.*

BRANCH OFFICES—Chicago: Otis Building. Pittsburgh: Park Building. Boston: Equitable Building. Philadelphia: Real Estate Trust Building. Cleveland: New England Building. Cincinnati: Mercantile Library Building.

Subscription Price: United States and Mexico, \$5.00 per year; single copy, 20 cents; to Canada, \$7.50 per year; to other foreign countries, \$10.00 per year. Entered at the New York Post Office as Second-class Mail Matter.

Proposed Tariff Legislation

The majority members of the Ways and Means Committee of the House of Representatives have agreed on the provisions of a bill to amend the existing tariff act which has been adopted by the committee and is to be called up in the House on Thursday of this week, with the expectation of forcing its passage by Saturday. This bill marks a distinct departure from the principles of the party now in control of the National Administration and of Congress.

Yielding to public sentiment, and recognizing that the country is confronted by "a condition and not a theory," a distinctly protective measure has been evolved in providing for a duty on dyestuffs, which it is expected will be sufficient to safeguard this industry from destructive foreign competition. So anxious, however, are the framers of the bill to prevent, as far as lies in their power, a permanent adherence to the protection of manufacturers of dyestuffs that the bill provides that beginning five years after its passage these duties shall be reduced for five successive years by 20 per cent annually of the rate imposed so that at the end of the ten years dyestuff duties shall no longer be levied, and, further, if at the expiration of five years from the date of the passage of the act the President finds that there is not being manufactured as much as 60 per cent of the domestic consumption of such articles he shall by proclamation so declare and then the special duties now imposed shall no longer be levied.

This imposition of protective duties, however, is not the only means by which this industry, as well as American industries generally, will hereafter be safeguarded. Another portion of the bill provides that it shall be unlawful for any person importing any article from any foreign country into the United States to sell such articles here at a price substantially less than the actual market value or wholesale price of such articles, at the time of exportation to the United States, in the principal markets of the country of their production or of other foreign countries to which they are commonly exported, after adding to such market value or wholesale price the freight, duty and other charges and expenses incident to the importation and sale thereof in the United States. It is provided, however, that such act or acts must be done with the intent of destroying or injuring an industry in the

United States or preventing the establishment of any industry here or of restraining or monopolizing any part of trade or commerce of such articles in this country. A penalty is specified of a fine not exceeding \$5,000 or imprisonment not exceeding one year, or both, at the discretion of the court. Another provision is that any person injured in his business or property by reason of any violation of or combination or conspiracy to violate this section may sue therefor and shall recover threefold the damage sustained. Another provision forbids the importation of an article produced in a foreign country under any agreement that the importer or any other person in the United States shall not use or purchase such articles of any other person, the penalty for which is a special duty, equal to double the amount of the ordinary duty.

While it would be an easy matter to suggest provisions which would be more efficacious in promoting the interests of American manufacturers and safeguarding them from destructive competition following the war, it is nevertheless gratifying to note that a disposition exists among those at present in control of national legislation to do something for our business interests. They have done so much to injure these interests as to place themselves in a position which is regarded as one of direct antagonism. It is possible that this slight change of front may be made for political reasons, in view of the approaching Presidential and Congressional campaign, but the business interests of the country should probably be thankful for whatever is done in their behalf, no matter what may be the ulterior purpose.

Resale Shell Machinery

For many months machine-tool builders have been speculating on the probable effect on their industry of the resale of tools which were bought, some of them in lots of a hundred or more, by manufacturers who entered the business of making shells. The issuance of lists of machines for resale by companies which have finished their contracts indicates that the questions long asked in this connection may soon be answered.

A hopeful view held by many has been that the tools purchased for munitions work would be fit only for the scrap pile. To a certain extent this will prove true, but probably not to the degree which sanguine sellers expected. Many standard

machines were taken in the rush for equipment, and these do not wear out so easily. Indeed, it might almost be said that it would be a reflection on the builders if they did. It is true that rough, reckless handling and forced production have injured the machines, and many parts have been broken. Supplying parts broken through the ignorance of workmen has been a good business. But the machines can be renovated, and with parts replaced they will be useful for some time.

Most encouraging to those who have feared a surplus of used tools in the market is the fact that a majority of the machines taken by munitions makers were of the single-purpose type, or standard tools so modified that they are not readily adaptable to ordinary manufacturing. The beds of lathes were shortened; they were denuded of tailstock, and a turret was mounted on the carriage. Changes were made in drive and in feed mechanism.

Still another reason for encouragement to machine-tool manufacturers is that the larger manufacturing plants which bought tools to fill war orders will retain at least some of this extra equipment for their regular work. This is true of a large locomotive company, and also of one making pneumatic tools and machinery which was so well versed in boring small cylinders that it turned its attention to shell production with confidence and with practically no effort. The latter company is about through with shells, but finds the demand for its normal products large enough to keep its plants busy at capacity.

It is a noteworthy fact that several companies which produced shells are not anxious for further work of the kind if it were to be had. One reason may be the closer margin of profit which has prevailed in recent months, while another is the extent to which activity in the regular lines of these companies has increased.

More Common-Labor-Saving Devices

Labor-saving devices are advancing further into the field of common labor. Their replacement of such labor has long been a feature in large industries where quantity production makes it possible soon to absorb the capital outlay for the machinery; but now, even in the small plants, there is more consideration of equipment to replace workers of the lower wage scales. It is not that the wages of this class have advanced out of proportion, generally speaking, to those of the more skilled workers, nor is there a greatly disproportionate scarcity of common labor. This later increase in man-displacing machinery is largely the result of inefficiency even in workmen of whom not much has been expected. The fact is that the price per man-hour has worked so far out of line, measured in results and also in terms of the nervous strain on shop heads, that steps are being taken for larger elimination of uncertainty as to output. While immediate results may not show in dollars and cents, yet for the long pull owners are considering more than ever the cost of the harassment of their responsible men by careless and irresponsible employees.

Efficiency inoculation does not readily "take"; least of all has been its effect upon labor of the strong-arm-and-back class. Inventors will still do

much to compensate certain industries for the disappearance of "cheap hand labor," but there will still be the serious problem with which the Government as well as industry will have to reckon, in the large numbers of workers who are neither teachable nor susceptible of further mental development.

Capital Results of Our Foreign Trade

Very large favorable balances were a feature of our foreign trade throughout last year, and thus that has become an old story. There is a new story in our foreign trade, however, in that each successive month this year, through May, has made a new high record for imports, a fact that is perhaps not generally apprehended. Our imports do not ordinarily advance by such leaps and bounds, by any means. High points in our imports—months in which previous records were broken—have been as follows: December, 1906; December, 1909; December, 1911; December, 1913, representing intervals of two or three years, December invariably being the month of the year in which the record was broken. It was not until January of this year that the record of December, 1913, was broken. February, March, April and May followed with successive new records, the May imports, as indicated by preliminary returns, being \$229,000,000 as compared with \$184,025,571 in December, 1913, the high record prior to this year.

Successive high records for a favorable trade balance have been made as follows: December, 1880; October, 1896; October, November and December, 1898; October, 1900; December, 1903; December, 1905; December, 1907; January, 1908; November, 1912; October, 1913, the last indicated record being \$138,912,162. The first month of last year broke that record, and six months of the twelve stood above it. Thus extremely large trade balances featured all of last year, but it is only this year that extremely large imports have occurred. However, each of the five balances thus far this year has been in excess of the balance in October, 1913, so that, despite the heavy imports, this year has done better even than last year in the matter of the merchandise balance. The average balance in the five months this year is 33 per cent in excess of last year's average, thus setting at rest any fear that the increasing imports may be undermining our favorable balance. The exports have increased still more than the imports. The trade is of tremendous proportions, the total in May, imports plus exports, being at a rate nearly three times that of 1906, ten years ago.

The nature of the imports is well worth studying, particularly from two viewpoints, their revenue-producing character and their character as representing an aid or an injury to American industries.

As to revenue-producing character the showing is extremely bad. The revenue is wretchedly small in proportion to the total value of the imports, and this is due in part to the change in the tariff in October, 1913, and in part to a change that occurred after the war started, in the character of the imports. The comparable periods are the ten months ending April, 1913, the last such period before the

change in tariff, the ten months ending April, 1915, substantially the first ten months of war, and the ten months ending April, 1916, the last period for which full data are available. In the ten months ending April, 1913, imports of \$1,366,536,251 (53.46 per cent being free) produced \$258,451,236 of customs duties. In the ten months ending April, 1915, \$1,374,189,749 (61.77 per cent being free) produced \$247,774,507. That was, temporarily at least, a better showing than would be expected from the new tariff, there being only a moderate decrease in revenue while there was a slight increase in the total imports. Thereafter a complete change must have occurred in the nature of the imports, for in the ten months ending April, 1916, \$1,722,368,115 of imports (68.98 per cent free) produced only \$171,765,334 of revenue. Thus under the same tariff law imports increased 25.3 per cent and revenue decreased 1.5 per cent. This curious change was due only in part to the proportion of free imports increasing. There was a slight increase even in the dutiable imports, commodities carrying higher duties evidently yielding to commodities carrying lower duties.

As to the character of the imports in their relation to industry there has been a very decided improvement. There has been a large increase in crude materials for manufacturing and a large decrease in manufactures ready for consumption. In foodstuffs, crude and finished, the increases have been only slight. It is evident that the increase in imports has been due chiefly to our industrial activity, whereby the manufacturing industries have required more raw and partly manufactured materials, while with our prosperity we have purchased less, rather than more, of manufactured goods ready for consumption. Whether this change is due in part to less desire to make such purchases or entirely to inability to obtain the goods is another matter. The fact is that we have not done so.

There is a natural desire to measure the extent to which the favorable trade balance has prospered us, and the extent to which the capital of the country has been augmented. Of course, no accurate measurement is possible, but the figures are so large that they are suggestive, even though many items cannot be the subject of anything more than guesses. As the merchandise balance is not directly a measure of our profits, there being an unseen balance as well as a movement of gold, it is necessary to proceed by the comparative method. In the ten years before the war, through the calendar year 1913, the merchandise balance averaged \$486,600,000 in our favor, and showed only relatively minor fluctuations in the period, while the gold movement represented an average of \$5,600,000 coming into the country, so that there was left an average of \$481,000,000 a year to be settled by other means, such, for instance, as the movement of securities, the payment of interest and dividends on securities held abroad, freights paid to foreign vessel owners, money spent abroad by American tourists, etc.

In the calendar year 1914 the merchandise balance was only \$324,348,049 in our favor, while gold exports exceeded imports by \$165,228,415, so that the combined showing was only \$159,000,000 in our favor, instead of the previous standard of \$481,000,000, making a deficiency of \$322,000,000. In

1915 the merchandise balance was \$1,768,883,677, against which there was an excess of \$420,528,672 in gold imports, leaving \$1,348,355,005 to be settled by other means. Deducting \$481,000,000 as the normal balance, as well as the \$322,000,000 deficit accumulated in 1914, there is left \$545,000,000 to the good. Making the same computation for the first five months of this year we have \$977,000,000 of a merchandise balance with \$7,000,000 net gold imports, leaving an accumulation of \$770,000,000 after allowance for the previous standard rate of merchandise balance. Thus there appears to have accumulated to our credit, to June 1, 1916, \$1,315,000,000 either of credit or of a balance that has been settled by some other means than gold, and this is after allowing for \$250,000,000 of the merchandise exports to have been settled by the \$250,000,000 of gold that has come in since January 1, 1914, in excess of the small annual amount that had previously been coming in.

Thus we are ahead, altogether, in gold, credit, etc., to the extent of fully \$1,600,000,000, and our capital is increased by this amount, provided we have not had an excess of unseen expenses. We have saved by a reduction in the amount of money spent abroad by American tourists, while we have lost in paying higher freights on such of our imports, a slightly smaller proportion than formerly, as are brought by foreign vessels, while we have gained slightly by having more American vessels carrying exports. Probably no great sum should be set as the net total of these and other items that cannot be gauged, and thus it seems fair to assume that the capital of the country has thus far been increased by about a billion and a half, in gold, in foreign securities purchased, chiefly the Anglo-French loan, in American securities returned, and in various minor items. This is not the billions sometimes loosely spoken of, but it is a very considerable sum.

A Poor Manganese Showing

Record high prices and a large demand resulted in an output of only 9651 gross tons of manganese ore in the United States in 1915, according to the Geological Survey. And this was three times that for 1914 and the largest since 1901. Last year's production came from 34 operators in 10 States. It is an unsatisfactory revelation of the apparently meager domestic supply of a raw material so absolutely essential to the great steel industry of this country.

The lack of a home supply is the more impressive when it is realized that to furnish the steel industry with the 201,743 tons of ferromanganese, available and necessary for consumption last year, over 500,000 tons of manganese ore was necessary. Our domestic output was therefore only 1.9 per cent of that actually necessary. It was only 2.5 per cent of the ore necessary to produce the 146,542 tons of the alloy made within our own borders. At the present rate of steel output, estimated to require from 270,000 to 295,000 tons of ferromanganese for 1916, our ore requirements rise to 675,000 to 700,000 tons for the year. Unless the domestic output of ore can be greatly enlarged, it will be only 1.3 to 1.4 per cent of that necessary.

Dependent as we are, and are likely to continue to be for many years, on foreign sources for manganese, it behooves the metallurgists of the country to take advantage of every possible suggestion that may seem to offer a substitute for manganese in steel, especially from a preparedness point of view. The war's lessons in this field, from present indications here and abroad, promise to be unusually fruitful.

CORRESPONDENCE

Substitutes for Ferromanganese

To the Editor: With the shortage of supply of the 80 per cent ferromanganese and its excessive cost, due to the cessation of exports from Europe, the American steel maker naturally became somewhat pessimistic and fearful for his source of supply of this all-important constituent. Thanks to American ingenuity, American metallurgists and producers, urged on by necessity, were soon able to cope with the situation by the domestic production of high manganese, specular irons and by the use of substitutes. In your able editorial, which appeared in the issue of June 15, you called attention to the various measures to which some of the steel makers have had to resort in order to offset the shortage of supply and the excessively high cost of ferromanganese. Naturally many of them resorted to the use of spiegel-eisen. Because of the low manganese content and the proportionately larger amounts necessary to be used, they were forced to the additional cost and inconvenience of preheating this material. Some others reduced the percentage of 80 per cent ferromanganese and in addition used an equivalent amount of specular irons of lower percentages in order to offset the initial preheating. Some others were forced to resort to this latter method in view of the high phosphorus content of spiegel-eisen, the extensive use of which might affect the specification tolerances for phosphorus. Unfortunately, too, at times such as these the steel maker very often has presented to him many substitutes to meet his various needs, only to find by experience that they are of no particular value.

SILICON—TITANIUM—ALUMINUM

With the embargo which has been placed on Caucasus ores by the Allies, Germany has been able to meet the shortage of ferromanganese by the use of calcium-silicide. In this country, American steel manufacturers have tried as a substitute a by-product of the abrasive industries, referred to in your article as silicon-aluminum-titanium, with indifferent and variable success. The designation of this alloy is in a measure a misnomer, inasmuch as only a relatively small amount of aluminum is present. In addition to this small aluminum content there is at present a large per cent of alumina, which has no function as a deoxidizer but in reality is a menace, in that the inactive alumina will not always find its way to the slag but remains in the steel as a slag inclusion. Some of the titanium present in this alloy is also present in the form of its most stable compound, titanium-oxide, and has no value as a deoxidizer. Inasmuch as this material is a by-product, the deoxidizing constituents, silicon, titanium and aluminum, are present in variable quantities. The writer used some of this material, hoping that it would be a remedy for the adverse situation arising from the shortage of ferromanganese. The results were indifferent and a disappointment, insofar as the aluminum, for which a deoxidizing value had been hoped, manifested itself as alumina.

FERRO-CARBON-TITANIUM

Realizing that the function of manganese in the final product contributes to the ultimate strength of steel only indirectly in that the usual percentage of approximately 75 points of manganese assures complete de-

oxidation and a resulting homogeneity, some tests were instituted, wherein the final manganese content was reduced about 35 per cent further. In the preliminary experiments the original ferromanganese addition was reduced about 35 per cent and the deoxidation was further augmented by the use of ferro-carbon-titanium. Although ferro-carbon-titanium normally sells at a considerably higher price than ferromanganese, its substitution was economically possible at the current price of 80 per cent ferromanganese, permitting the conservation of the present supply of the latter. Physical tests indicated that the elastic limit, ultimate strength, elongation and contraction were the same as in previous practice when 80 per cent ferromanganese was in abundance. Further economies were found from experiments which led to the use of 30 per cent of the original 80 per cent ferromanganese addition, augmented by twice the amount of 40 per cent spiegel and the addition of 3 lb. of ferro-carbon-titanium alloy per net ton of metal charged.

With the shortage of ferromanganese, American metallurgists have begun investigations to determine whether a manganese content of 75 points in steel castings is really essential, and whether the lower limits usually specified in rolled products are not sufficient.

W. A. JANSEN,

Superintendent Steel Foundry, Bettendorf Company.
Bettendorf, Iowa, June 28, 1916.

A Million Tons of Unfinished Steel to Europe

Exports of ingots, billets and blooms from the United States have assumed enormous proportions—at the rate of over 1,000,000 tons per year. With an increase from 50,942 tons per month in the last quarter of 1915 to 84,770 tons per month for the first four months of 1916, the outgo has reached the record rate of 1,017,240 tons per year. The following table from Government data is interesting:

	Gross Tons	Tons per Month
January, 1916	55,815	
February, 1916	87,306	88,770
March, 1916	107,696	
April, 1916	88,764	
Last quarter, 1915	152,826	50,942
1915	560,728	46,727

The present export rate is therefore nearly twice that of 1915 and is strong testimony to the extent to which foreign steel producers are unable to meet the demand. To June 1, 1916, Great Britain had imported only 101,347 gross tons of ingots, billets, blooms and slabs from the United States, leaving about 238,000 tons of our total exports of 339,081 tons to May 1, 1916, to go to other countries. In the first quarter of this year France has taken 194,367 tons of ingots, billets and blooms, the rate greatly increasing each month.

Pennsylvania Sale to Bethlehem Confirmed

At Philadelphia, July 1, in the suit brought by Clarence H. Venner, Judge McPherson of the United States Circuit Court of Appeals refused to interfere with the plan of the Bethlehem Steel Company to purchase the assets of the Pennsylvania Steel Company of New Jersey and its subsidiaries.

The Snyder Electric Furnace Company, 53 West Jackson Boulevard, Chicago, calls attention to an error on page 1587 in THE IRON AGE of June 29, in which the statement is made that the Western Crucible Steel Casting Company is installing a Snyder electric furnace which will produce 2800 lbs. of metal per 24 hrs. This should be 28,000 lbs. of metal per 24 hrs.

The Foundation Company, Ltd., Montreal, has received two contracts from the Algoma Steel Corporation, Sault Ste. Marie, Ontario. One is for the revision of the yard, including the engineering and constructing of three plate-girder bridges, and the other is for the construction of the foundations of two open-hearth furnaces and a gas producer.

Provisions of the New Tax on Munitions

Rates Range from 1 to 8 Per Cent of Gross Receipts—Copper Smelting and Refining Included—Ten Per Cent Profit Exempt

WASHINGTON, D. C., July 4, 1916.—Chairman Kitchin of the Ways and Means Committee on July 1 formally introduced the omnibus revenue bill. It will be reported to the House on Thursday and taken up under a special rule providing for a final vote on Saturday. It will be promptly considered by the Senate Finance Committee and will probably be passed and signed on or before July 25.

The general character of the bill has been fully foreshadowed in THE IRON AGE. Income taxes, both individual and corporate, are increased nearly 100 per cent; a federal inheritance tax levied by the bill imposes rates ranging from 1 to 5 per cent on estates of \$50,000 and upward. A tax on munitions manufacturers is a novel feature of the measure, the rates ranging from 1 to 8 per cent of the gross receipts of individuals, partnerships or corporations engaged in the manufacture of various specified classes of war material, including the smelting, refining or alloying of copper, an exemption equal to a net profit of 10 per cent being allowed in all cases. The provisions of the Rainey tariff commission bill, heretofore described in this correspondence, are included in the measure, increased duties on dyestuffs are provided and a so-called anti-dumping clause is embraced in the bill. Certain of the special taxes on bankers, brokers, etc., levied by the emergency war revenue act are re-enacted, but all the documentary stamp taxes embraced in Schedule A of that statute are repealed. The bill is intended to produce a net increase of revenue of \$197,000,000, but is not calculated to meet any extraordinary expenditures due to the Mexican crisis, which are to be defrayed by the cash balance now in the treasury, supplemented, if necessary, by a bond issue to be hereafter authorized.

THE MUNITIONS TAX

The provisions of the munitions manufacturers' tax will be examined by readers of THE IRON AGE with special interest. Section 201 provides for the imposition of these taxes as follows:

SECTION 201. That every person manufacturing gunpowder or other explosives shall pay for each taxable year an excise tax equivalent to the following percentages of the gross receipts during such year from the sale or disposition of such explosives manufactured in the United States, except blasting powder and dynamite:

Five per centum of the amount of such receipts not in excess of \$1,000,000, and

Eight per centum of the amount by which such receipts exceed \$1,000,000.

Every person manufacturing (a) cartridges, loaded or unloaded, caps or primers; or (b) projectiles, shells, or torpedoes of any kind, including shrapnel, loaded or unloaded, or fuses; or (c) firearms of any kind, including small arms, cannons, machine guns, rifles, and bayonets; or (d) any parts of any of the articles mentioned in (a), (b), or (c), shall pay for each taxable year an excise tax equivalent to the following percentages of the gross receipts during such year from the sale or disposition of any such articles manufactured in the United States:

Two per centum of the amount of such receipts not in excess of \$250,000;

Three per centum of the amount by which such receipts exceed \$250,000 and do not exceed \$500,000;

Four per centum of the amount by which such receipts exceed \$500,000 and do not exceed \$1,000,000; and

Five per centum of the amount by which such receipts exceed \$1,000,000.

Every person smelting copper ore, refining metallic copper, or alloying copper, shall pay for each taxable year an excise tax equivalent to the following percentages of the gross receipts during such year from the sale or disposition of refined copper or copper alloys and from the sale or disposition of crude or unrefined copper if sold or disposed of for any purpose except for refining or alloying:

One per centum of the amount by which such receipts exceed \$25,000 and do not exceed \$1,000,000;

Two per centum of the amount by which such receipts exceed \$1,000,000 and do not exceed \$10,000,000; and

Three per centum of the amount by which such receipts exceed \$10,000,000.

Evasion of the taxes provided by the bill are guarded against by the following provision:

SECTION 202. If any person during any taxable year or part thereof, whether under any agreement, arrangement, or understanding, or otherwise, sells or disposes of any such article at less than the fair market price obtainable therefor, either (a) in such manner as directly or indirectly to benefit such person or any person directly or indirectly interested in the business of such person, or (b) with intent to cause such benefit, the amount of the gross receipts of such person during such year or part thereof from the sale or disposition of such article shall be taken to be the amount which would have been received from the sale or disposition of such article if sold at the fair market price.

Ten Per Cent Profit

Exemptions including a 10 per cent net profit are prescribed by Section 203, as follows:

SECTION 203. That if the net profit derived during such year from the sale or disposition of such articles manufactured in the United States is less than ten per centum, no tax shall be levied, collected, and paid; and if the payment of the tax would reduce such net profit below ten per centum, the tax to be levied, collected and paid shall be equal to the net profit in excess of ten per centum. Such net profit shall be computed on the amount actually invested in the United States in the manufacture of such articles, making reasonable allowance, in the case of the increase or decrease of such amount during the taxable year, for the proportion of such year during which such increased or decreased amount has been employed in the manufacture of such articles.

In cases where such person has undivided capital invested in the manufacture of the articles specified in section 201 and of other articles, the amount invested in the manufacture of the articles specified in section 201 shall be considered as in the same ratio to the total amount invested as the gross receipts from the sale and disposition of such articles bear to the total gross receipts from the sale and disposition of all articles manufactured.

The duty of establishing to the satisfaction of the Commissioner of Internal Revenue the fact that the net profit is less than ten per centum or that the payment of the tax would reduce the net profit below ten per centum shall devolve upon the person subject to the tax.

The Basis of "Net Profits"

In order that there may be no controversy as to the basis upon which "net profits" may be legally calculated under the terms of the bill, the following specifications are incorporated:

SECTION 204. That when used in this title the term "net profit" means the aggregate gross receipts during the taxable year from the sale and disposition of such articles manufactured in the United States less the following items, or the proportionate part thereof chargeable to the manufacture of such articles, any deductions not kept separate from similar items arising in connection with the joint manufacture of other articles not specified in section 201 being ascertained according to the ratio above prescribed for the determination of the amount invested:

(a) The cost of raw materials entering into the manufacture;

(b) Running expenses, including rentals, cost of repairs and maintenance, heat, power, insurance, management, salaries, and wages;

(c) Interest paid within the taxable year on debts or loans contracted to meet the needs of the business, and the proceeds of which have been actually used to meet such needs;

(d) Taxes of all kinds paid during the taxable year with respect to the business or property relating to the manufacture:

(e) Losses actually sustained within the taxable year in connection with the business of manufacturing such articles, including losses from fire, flood, storm, or other casualty, and not compensated for by insurance or otherwise; and

(f) A reasonable allowance, according to the conditions peculiar to each concern, for amortization of the values of buildings and machinery, account being taken of the exceptional depreciation of special plants.

Section 205 provides that any person manufacturing any of the articles specified "through the agency of a subsidiary concern or a sub-contractor shall be deemed the manufacturer of such articles instead of the subsidiary concern or sub-contractor." Manufacturers subject to these provisions of the bill are required to make returns on or before Feb. 1 of each year under oath to the local collector of internal revenue and the taxes thus determined to be due must be paid on or before April 1. Any person violating these provisions of the proposed law or knowingly making a false statement in any return, is rendered liable, in addition to paying any tax which may be found to be due, to be fined not more than \$10,000, or imprisoned not exceeding one year, or both, in the discretion of the court.

Lest the new law may be invalidated should the courts find any of its provisions unconstitutional, it is provided that if any part of the act shall be adjudged to be invalid, such judgment shall not impair the remainder of the act, but shall be confined to the part thereof directly involved in the controversy in which such judgment shall have been rendered. W. L. C.

June Ore Shipments a Record

June iron-ore shipments from the Lake Superior region were 9,507,578 gross tons, the record month in the history of Lake ore carrying. They exceeded those for May by 1,057,996 tons, then the record month, and were 58.32 per cent greater than those for June, 1915. The comparative shipments by ports for May and for the season were as follows in gross tons:

	June, 1915	June, 1916	To July 1, 1915	To July 1, 1916
Escanaba	720,264	1,159,424	1,248,330	2,602,824
Marquette	363,637	539,327	547,002	1,154,140
Ashland	604,127	1,101,370	1,161,792	2,204,263
Superior	926,536	1,945,234	1,777,600	3,878,915
Duluth	2,146,501	3,116,665	4,295,811	6,325,990
Two Harbors	1,244,026	1,645,556	2,490,248	3,449,435
Total	6,005,091	9,507,576	11,521,283	19,615,567
Increase, 1916		3,502,485		8,094,284

The increase to July 1, this year, is 70.26 per cent, which reveals the rate that is making for a record season's shipments. The Duluth and Superior percentage of the total to July 1, this year, was 52.01 per cent, against 52.70 per cent last year. The Escanaba proportion this year is 13.27 per cent, as compared with 10.86 per cent last year.

Locomotive Orders Decreasing

Locomotive orders in June were the lowest this year. In the last three weeks orders for 77 have been placed, while new inquiries are for less than 40. The Baldwin Locomotive Works will build 25 Mallets for the New York Central and 8 Santa Fes for the Texas & Pacific, while the Lima Locomotive Corporation will furnish the Chesapeake & Ohio with 25 Mallet locomotives. It is understood that the Canadian Locomotive Company has secured the Russian order for 1000 small locomotives and that at least a large majority of these will be sublet to the American Locomotive Company, the Baldwin Locomotive Works and the Lima Locomotive Corporation. It is reported that the Baldwin Locomotive Works has taken an order for 100 small trench locomotives for the French Government and that the Westinghouse Electric & Mfg. Company will furnish the New York, New Haven & Hartford with 100 electric engines.

The Ransome Concrete Machinery Company, with executive offices at 115 Broadway, New York City, and an enlarged factory at Dunellen, N. J., has established another office at St. Louis, Mo., located at 12-18 South Twelfth Street, with E. Gwynn Robinson, agent. The latest types of all kinds of mixers, from the bantam to the road paver, will there be on exhibition.

CONTENTS

Dispatch System of Norton Grinding Company	1
Keeping Track of Work in Process	6
Tennessee Company Improvements	9
A Heavy Boring Lathe for 6-In. Shells	9
The French Army Helmets	9
A Motor-Driven Seam-Welding Machine	10
The Bulletin Board as a Safety Adjunct	10
Steel Storage in a Hartford Factory	11
New Universal Turret Lathe	14
Machine Milling Two Keyseats at Once	15
Buying Material on a Scientific Basis	16
Heat Losses in the Gas Engine	19
A Grinding Machine Circulating Pump	19
Recrystallization of Boiler Tubes	20
Alternating Current Driving in Factories	21
Condenser to Be Made by Ingersoll-Rand Company	21
French Duty on Tool Steel	21
Condenser Tube Troubles	22
A Theory of the Corrosion of Steel	23
Adjustable-Head Bench Milling Machine	23
American Society for Testing Materials	24
American Car & Foundry Report	27
Mesaba Strike Waning	27
Steel Corporation Improvements and New Work	27
Proposed Tariff Legislation	28
Resale Shell Machinery	28
More Common-Labor-Saving Devices	29
Capital Results of Our Foreign Trade	29
A Poor Manganese Showing	30
Correspondence	31
A Million Tons of Unfinished Steel to Europe	31
Pennsylvania Sale to Bethlehem Confirmed	31
Provisions of the New Tax on Munitions	32
June Ore Shipments a Record	33
Locomotive Orders Decreasing	33
Less Pig Iron in June	34
Blast Furnace Notes	35
New Installations of Rennerfelt Furnaces	35
Iron and Steel Markets	36
German Steel Output for April	47
Iron and Industrial Stocks	47
The Tungsten Molybdenum System	47
Finished Iron and Steel Prices, Pittsburgh	48
Metal Markets	49
May Iron and Steel Exports a Record	49
Review of the Tin Situation	50
Book Review	51
Stainless Steel from a German Viewpoint	51
The Corrosion of Condenser Tubes	51
Some Welsh Tin-Plate Details	51
Personal	52
Midvale Establishes New Office Department	53
Another Electric Steel Plant	53
Providence Engineers' Annual Meeting	53
Mechanical Engineers' Annual Meeting	53
Strikes and Settlements	54
Steel Bar and Barb Wire Exports	54
Larger Imports of Manganese Ore	54
Pittsburgh and Nearby Districts	55
The New British High Speed Steel	55
Ohio Works Get New Shell Orders	55
Machinery Markets and News of the Works	56
Spray Cooling Ponds	67
An Improved Design in Power Pumps	67
Carpenter Steel Adds to Open-Hearth Capacity	67
Judicial Decisions	68

LESS PIG IRON IN JUNE

DAILY PRODUCTION RATE FALLS OFF 1500 TONS

BLAST FURNACE PERFORMANCE SLACKENS IN NEARLY ALL DISTRICTS

There was a general letting down at the blast furnaces of the country in June, the output of pig iron being 3,211,588 tons, or 107,053 tons a day, as against 3,361,000 tons in May, or 108,422 tons a day. Steel works furnaces are responsible for nearly all of the falling off, there being indications that heavy driving for many months is having its natural effect. There was a net gain of two furnaces in the month, 323 being in blast July 1 against 321 one month previous. However, based on operations in June our capacity rating for July 1 is less than that of June 1—107,822 tons a day against 108,386 tons.

DAILY RATE OF PRODUCTION

The daily rate of production of coke and anthracite pig iron by months, from June, 1915, is as follows:

DAILY RATE OF PIG-IRON PRODUCTION BY MONTHS—GROSS TONS		
	Steel Works	Merchant
June, 1915	59,022	20,339
July	62,895	19,796
August	67,801	21,865
September	70,977	24,108
October	73,595	27,227
November	73,282	27,962
December	73,647	29,686
January, 1916	72,614	30,132
February	75,305	31,151
March	76,274	31,393
April	77,226	30,366
May	77,706	30,716
June	76,526	30,527
		107,053

OUTPUT BY DISTRICTS

The accompanying table gives the production of all coke and anthracite furnaces in June and the three months preceding:

MONTHLY PIG-IRON PRODUCTION—GROSS TONS					
	Mar. (31 days)	Apr. (30 days)	May (31 days)	June (30 days)	
New York	205,034	189,312	210,464	190,140	
New Jersey	0	1,538	6,686	6,379	
Lehigh Valley	109,598	112,210	117,870	111,689	
Schuylkill Valley	94,264	90,753	94,254	93,552	
Lower Susquehanna and Lebanon Valley	63,142	69,407	80,293	75,092	
Pittsburgh district	793,910	752,068	750,903	728,071	
Shenango Valley	193,432	191,700	195,867	172,259	
Western Pennsylvania	175,738	165,790	167,913	157,909	
Maryland, Virginia and Kentucky	93,376	90,584	94,302	85,687	
Wheeling district	120,222	127,101	131,764	125,889	
Mahoning Valley	334,527	309,045	324,739	315,675	
Central and Northern Ohio	247,833	239,963	274,693	274,526	
Hocking Valley and Hanging Rock	53,237	50,120	46,079	48,640	
Chicago district	479,659	467,147	481,714	462,394	
Mich., Minn., Mo., Wis. and Col.	113,099	119,634	127,278	123,116	
Alabama	235,483	227,417	223,439	204,076	
Tennessee	25,137	25,424	32,815	33,494	
Total	3,337,691	3,227,768	3,361,073	3,211,588	

PRODUCTION OF STEEL COMPANIES

Returns from all furnaces of the United States Steel Corporation and the various independent steel companies show the following totals of product month by month. Only steel-making iron is included in the figures below, together with ferromanganese and spiegeleisen. These last, while stated separately, are also included in the columns of "total production."

Production of Steel Companies—Gross Tons					
	Pig, total production			Spiegeleisen and ferromanganese	
	1914	1915	1916	1914	1915
Jan.	1,261,430	1,115,944	2,251,035	17,325	18,041
Feb.	1,329,418	1,237,380	2,183,845	10,524	13,319
Mar.	1,704,688	1,551,082	2,365,116	20,133	22,274
Apr.	1,635,226	1,584,111	2,316,768	18,676	12,337
May	1,457,847	1,694,290	2,408,890	21,504	13,440
June	1,329,623	1,770,657	2,295,784	16,254	19,200
July	1,395,851	1,949,750	—	16,524	17,854
Aug.	1,455,054	2,101,818	—	11,577	27,463
Sept.	1,390,322	2,129,322	—	13,786	23,159
Oct.	1,271,820	2,281,456	—	17,435	23,992
Nov.	1,059,159	2,198,459	—	21,977	28,741
Dec.	1,034,802	2,283,047	—	20,733	25,004

CAPACITY IN BLAST JULY 1 AND JUNE 1

The following table shows the daily capacity in

gross tons of furnaces in blast July 1 and June 1 by districts:

Location of furnaces	Total number of stacks in blast	July 1		June 1	
		Number	Capacity per day	Number	Capacity per day
<i>New York:</i>					
Buffalo	19	17	5,950	17	6,174
Other New York	5	3	590	3	615
New Jersey	6	1	213	1	216
<i>Pennsylvania:</i>					
Lehigh Valley	20	12	3,362	14	3,615
Spiegel	2	2	195	2	212
Schuykill Val.	12	11	3,133	10	3,040
Lower Susquehanna	6	5	1,510	5	1,515
Lebanon Valley	8	7	1,003	6	917
Ferro and Spiegel	1	1	90	2	183
Pittsburgh Dist.	53	51	23,851	51	23,824
Ferro	3	2	372	3	398
Shenango Val.	19	19	5,942	19	6,076
Western Pa.	24	18	5,403	17	5,328
Ferro and Spiegel	3	1	103	1	75
Maryland	3	3	1,247	3	1,260
Ferro	1	1	108	1	112
Wheeling District	14	13	4,196	13	4,396
<i>Ohio:</i>					
Mahoning Val.	25	24	10,522	24	10,153
Central and Northern	24	23	9,154	23	8,984
Hock. Val. and Hang'g Rock	15	11	1,657	10	1,536
Illinois and Ind.	35	32	15,425	32	16,055
Ferro	1	1	87	1	84
Michigan, Wis. & Minn.	12	11	2,952	11	3,043
Colorado and Mo.	6	3	998	3	1,015
Ferro	1	1	153	0	0
<i>The South:</i>					
Virginia	18	8	989	7	826
Kentucky	5	4	558	4	628
Alabama	38	28	7,018	27	7,112
Tennessee	15	10	1,041	11	994
Total	394	323	107,822	321	108,386

Furnaces blown in in June include Keystone in the Schuylkill Valley, one Donora in the Pittsburgh district, Claire in the Shenango Valley, the new No. 9 stack of the Cambria Steel Company and Rebecca in western Pennsylvania, one Low Moor in Virginia, Jisco in the Hanging Rock district, one Iroquois in the Chicago district, one Pueblo in Colorado and one Ensley in Tennessee.

Among the furnaces blown out are one Hokendauqua and one Lock Ridge in the Lehigh Valley, one Lucy in Pittsburgh district, one stack of the Cambria Steel Company in western Pennsylvania, Buena Vista in Virginia, one South Works stack of the Illinois Steel Company in the Chicago district and Napier in Tennessee.

THE RECORD OF PRODUCTION

Production of Coke and Anthracite Pig Iron in the United States by Month Since Jan. 1, 1912—Gross Tons					
	1912	1913	1914	1915	1916
Jan.	2,057,911	2,795,331	1,885,054	1,601,421	3,185,121
Feb.	2,100,815	2,586,337	1,888,670	1,674,771	3,087,212
Mar.	2,405,318	2,763,563	2,347,867	2,063,834	3,337,691
Apr.	2,375,436	2,752,761	2,269,655	2,116,494	3,227,768
May	2,512,582	2,822,217	2,092,686	2,263,470	3,361,073
June	2,440,745	2,628,565	1,917,783	2,380,827	3,211,588
6 mo.	14,379,207	16,348,774	12,401,715	12,100,817	19,400,453
July	2,410,889	2,560,646	1,957,645	2,563,420	—
Aug.	2,512,421	2,545,763	1,995,261	2,779,647	—
Sept.	2,463,839	2,505,927	1,882,577	2,852,561	—
Oct.	2,689,933	2,546,261	1,778,186	3,125,491	—
Nov.	2,630,854	2,233,123	1,518,316	3,037,308	—
Dec.	2,782,737	1,983,607	1,515,752	3,203,322	—
Total, yr.	29,383,490	30,724,101	23,049,752	29,662,566	—

DIAGRAM OF PIG-IRON PRODUCTION AND PRICES

The figures for daily average production, beginning January, 1909, are as follows:

Daily Average Production of Coke and Anthracite Pig Iron in the United States by Months Since Jan. 1, 1909—Gross Tons								
	1909	1910	1911	1912	1913	1914	1915	1916
Jan.	57,975	84,148	56,752	66,384	90,172	60,808	51,659	102,746
Feb.	60,976	85,619	64,080	72,442	92,369	67,453	59,813	106,456
Mar.	59,232	84,459	70,036	77,591	89,147	75,738	66,575	107,667
Apr.	57,962	82,792	68,836	79,181	91,759	75,665	70,550	107,592
May	60,753	77,102	61,079	81,051	91,039	67,506	73,015	108,422
June	64,636	75,516	59,585	81,358	87,619	63,916	79,361	107,053
July	67,793	69,305	57,841	77,738	82,601	63,150	82,691	—
Aug.	72,546	67,963	62,150	81,046	82,057	64,363	89,666	—
Sept.	79,507	68,476	65,903	82,128	83,531	62,753	95,085	—
Oct.	83,856	67,520	67,811	86,722	82,132	57,361	100,822	—
Nov.	84,917	63,659	66,648	87,697	74,453	50,611	101,244	—
Dec.	85,022	57,349	65,912	89,766	63,987	48,896	103,333	—

The fluctuations in pig-iron production from January, 1908, to the present time are shown in the accompanying chart. The figures represented by the heavy

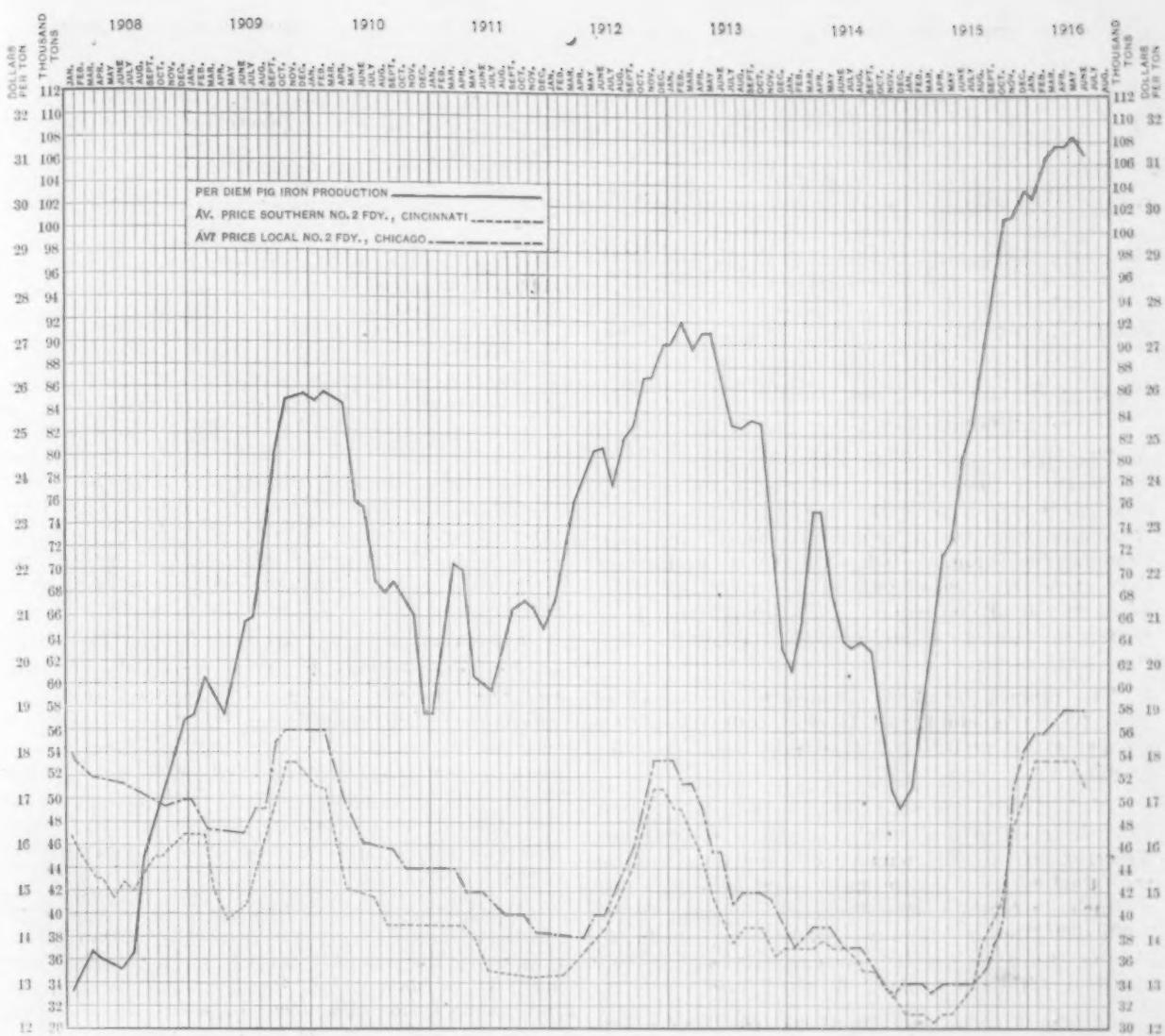


Diagram of Daily Average Production by Months of Coke and Anthracite Pig Iron in the United States from Jan. 1, 1908, to June 1, 1916; Also of Monthly Average Prices of Southern No. 2 Foundry Iron at Cincinnati and Local No. 2 Foundry Iron at Chicago District Furnace

lines are those of daily average production, by months, of coke and anthracite iron. The two other curves on the chart represent monthly average prices of Southern No. 2 foundry pig iron at Cincinnati and of local No. 2 foundry iron at furnace at Chicago. They are based on the weekly market quotations of THE IRON AGE.

Blast Furnace Notes

The record for daily production at the Bethlehem Steel Company's blast furnace department was broken June 28, when 2961 tons of iron was produced in 24 hr. The highest previous record, made on April 19, was 2931 tons.

Furnace D of the Iroquois Iron Company group at South Chicago, Ill., was blown in June 30 after being equipped with a new McKee top.

Grumwold furnace of the Reading Iron Company at Emmaus, Pa., will be blown in this week.

The furnace of the Donner Steel Company at Buffalo, N. Y., was out of blast from June 8 to June 26.

The blast furnace of the Struthers Furnace Company, Struthers, Ohio, which has been undergoing relining and extensive repairs, will be put in blast early this month, and will make Bessemer iron.

The Napier Iron Company blew out its furnace at Napier, Tenn., for relining on July 1.

The Spencer Wire Company, Worcester, Mass., has given its employees a bonus of 6 per cent of their wages for the year, amounting to about \$30,000.

New Installations of Rennerfelt Furnaces

Six more Rennerfelt electric steel furnaces have been sold by Hamilton & Hansell, 17 Battery Place, New York, as follows:

One $\frac{3}{4}$ -ton furnace, 225 kw., to the Samson Iron Works, Stockton, Cal., for making steel.

One $\frac{1}{2}$ -ton furnace, 100 kw., to the Titanium Alloy Mfg. Company, Niagara Falls, N. Y., for making bronze.

One $\frac{1}{2}$ -ton furnace, 100 kw., to the Gerline Brass Foundry Company, Kalamazoo, Mich., for making bronze.

One $\frac{3}{4}$ -ton furnace, 150-kw., to the Tungsten Products Company, Boulder, Col., for making ferrotungsten.

Two furnaces of 3 and 6 tons capacity have been sold to an American producer of ferrotungsten, the name being withheld for the present.

The sale of two electric furnaces to make bronze and three to make ferrotungsten is significant of the expansion in their use. These six furnaces make 14 Rennerfelt furnaces in operation or contracted for in the United States. Besides these, three have been sold in Europe, making 64 of this type in the world.

The Engineering Societies Building is also to accommodate the American Society of Civil Engineers. A mail ballot of that society announced at its meeting last week in Pittsburgh, showed a vote of 6 to 1, of 2963 ballots counted, in favor of joining the mechanical, mining and electrical engineering societies in the conduct of building and thus in moving its headquarters there. A large number indicated favoring a plan of spending \$250,000 to add two and one-half stories to the existing structure.

Iron and Steel Markets

HEAVY SPECIFICATIONS

Steel Corporation's Total 6,000,000 Tons

Pig-Iron Production Falls Off—Will Lake Ore Shipments Meet the Demand?

The unusual extent to which business now on the books of the steel companies is in the form of definite specifications is shown in the statement this week that the Steel Corporation, which for some time has had roundly 10,000,000 tons of unfilled orders, now has specifications for 6,000,000 tons. With this condition general in the trade there is no strong expectation of any material change in prices this year.

The figures for Steel Corporation orders as of June 30, to be published Monday, will show little change in the month and there may be a slight decrease.

With strictly domestic business lessening, as has been the case for some weeks, such a showing is confirmation of the very considerable new contracts for war steel reported in the latter part of June. One of these, taken by the Steel Corporation, is for 1,000,000 forgings for large shells. Late shell machining contracts are further confirmation, two just closed in Ohio representing 75,000 tons of steel.

Of the Russian rail inquiries, which were for 350,000 tons, independent rail makers have taken relatively little thus far. They are believed to be quite well sold on rails through the first quarter of 1917. The Steel Corporation has booked nearly 200,000 tons for Russia, deliveries running to July of next year.

Locomotive works are putting increasing pressure upon the plate mills and the oversold condition of some of the latter is indicated by their efforts to place round tonnages with other mills. Nearly 13,000 tons of plates have just been placed for five new Lake boats.

In other finished steel lines the features are further weakness in black sheets, in spite of higher wages and the high level of sheet bars; a decline of \$2 in galvanized sheets; some increase in demand for wire products, though the price advance expected in some quarters for July 1 did not come; rather more activity in bars, with sales of 35,000 tons, all for industrial and not war uses, reported at Chicago.

The ability of Lake Superior iron ore shippers to get down enough ore this year continues to figure in pig-iron and steel calculations throughout the market. June shipments were 9,507,000 tons or far beyond any previous record. To July 1 the season total was 19,615,000 tons. If July, August, September and October average 9,000,000 tons and November falls to 6,000,000 tons, the season total would be 61,615,000 tons. To maintain the present rate of pig-iron production a year would mean 64 to 65 millions of Lake ores and some leaders in the trade look for an ore shortage of several million tons.

Thus far the Mesaba miners' strike has not affected shipments, but if prolonged it can prove a serious factor and its developments are watched with no little concern.

Pig-iron production fell off about 1400 tons a day in June. The total was 3,211,588 tons, or 107,053 tons a day, against 3,361,073 tons in May, or 108,422 tons a day. Furnaces have been pushed so long that nearly all districts last month showed poor working. Thus the capacity rating came down from 108,422 tons a day for 321 furnaces active June 1 to 107,053 tons a day for 323 furnaces on July 1, the month showing a net gain of two in the active list.

The buying of steel-making pig iron for export goes on, and probably 25,000 tons was closed in the past week, largely for Italy. Bessemer iron is stiffening under this demand and \$21.50 at Valley furnace was done on one order. A 20,000-ton sale of basic in southern Ohio was made at close to an \$18 Valley furnace basis. Low scrap prices have brought a larger use of old material in open-hearth furnaces, which tends to hold basic pig iron to the present level.

The Carnegie Steel Company and Illinois Steel Company have been heavy buyers of scrap in the past week, the former taking from 75,000 to 100,000 tons at \$16 and higher, while in the Chicago district dealers showed a great eagerness for a share of the business at figures below \$14.50.

Pittsburgh

PITTSBURGH, PA., July 3, 1916.

The steel trade enters the second half of the year under most auspicious conditions. While it is true that buyers are placing orders at present only for such material as they must have, yet conditions with the mills are excellent, they having orders on their books for four or five months' run. Consumers, as a rule, are specifying freely against contracts; in a few cases there have been some cancellations, and in a few others consumers are not specifying for the full amount. These exceptional cases are not worrying the mills to any extent. Prices on everything are firm but do not show any signs of being higher. July 1 was the date on which the trade expected an advance in wire and wire nails, and possibly also on pipe, but nothing was done. Any falling off in domestic demand has been more than offset by an enormously heavy export demand which embraces Bessemer pig iron, open-hearth and Bessemer billets, tin plate and other finished products. This export demand is helping largely to sustain prices, which might otherwise have gone off because of the decline in domestic business. There has been some movement in Bessemer and basic iron and in Bessemer and open-hearth semi-finished steel, mostly for export on the latter, and the heavy buying of steel scrap by a local consumer has put the market in better shape. Many buyers have yet to place orders for material, and, while July and August will likely be quiet on account of the vacation period, a buying movement is looked for early in September for the last quarter of this year and the first quarter of 1917. Many consumers who have material due them in

A Comparison of Prices

Advances Over the Previous Week in Heavy Type, Declines in Italics
At date, one week, one month, and one year previous

July 5, June 28, June 7, July 7,				
Pig Iron, Per Gross Ton:	1916.	1916.	1916.	1915.
No. 2 X, Philadelphia....	\$19.75	\$19.75	\$20.25	\$14.25
No. 2, Valley furnace....	18.25	18.25	18.00	12.75
No. 2 Southern, Cin'ti....	16.90	16.90	17.65	12.65
No. 2, Birmingham, Ala....	14.00	14.00	14.75	9.75
No. 2, furnace, Chicago*....	19.00	19.00	19.00	13.00
Basic, del'd, eastern Pa....	19.50	19.50	20.00	13.75
Basic, Valley furnace....	18.00	18.00	18.00	12.65
Bessemer, Pittsburgh....	21.95	21.95	21.95	14.70
Malleable Bes., Ch'go*....	19.50	19.50	19.50	13.00
Gray forge, Pittsburgh....	18.70	18.70	18.70	13.45
L. S. charcoal, Chicago....	19.75	19.75	19.75	15.75

Billets, etc., Per Gross Ton:

Bess. billets, Pittsburgh....	42.00	42.00	45.00	20.50
O.-h. billets, Pittsburgh....	42.00	42.00	42.00	21.50
O.-h. sheet bars, P'gh....	42.00	42.00	42.00	22.00
Forging billets, base, P'gh....	69.00	69.00	69.00	27.00
O.-h. billets, Phila....	50.00	50.00	50.00	24.56
Wire rods, Pittsburgh....	50.00	50.00	55.00	25.50

Finished Iron and Steel,

Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Bess. rails, heavy, at mill	1.47 1/2	1.47 1/2	1.47 1/2	1.25
O.-h. rails, heavy, at mill	1.56 1/2	1.56 1/2	1.56 1/2	1.34
Iron bars, Philadelphia....	2.659	2.659	2.659	1.22 1/2
Iron bars, Pittsburgh....	2.50	2.50	2.60	1.25
Iron bars, Chicago....	2.35	2.35	2.35	1.20
Steel bars, Pittsburgh....	2.75	2.75	2.75	1.25
Steel bars, New York....	2.919	2.919	2.919	1.419
Tank plates, Pittsburgh....	3.25	3.25	3.75	1.20
Tank plates, New York....	3.419	3.419	3.919	1.369
Beams, etc., Pittsburgh....	2.50	2.50	2.60	1.25
Beams, etc., New York....	2.669	2.669	2.669	1.419
Skelp, grooved steel, P'gh....	2.35	2.35	2.35	1.15
Skelp, sheared steel, P'gh....	2.45	2.45	2.45	1.20
Steel hoops, Pittsburgh....	2.75	2.75	2.75	1.30

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

July 5, June 28, June 7, July 7,				
Sheets, Nails and Wire:	1916.	1916.	1916.	1915.
Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Sheets, black, No. 28, P'gh....	2.90	2.90	2.90	1.75
Galv. sheets, No. 28, P'gh....	4.50	4.60	4.75	4.50
Wire nails, Pittsburgh....	2.50	2.50	2.50	1.60
Cut nails, Pittsburgh....	2.60	2.60	2.60	1.55
Fence wire, base, P'gh....	2.45	2.45	2.45	1.40
Barb wire, galv., P'gh....	3.35	3.35	3.35	2.50

Old Material, Per Gross Ton:

July 5, June 28, June 7, July 7,				
Iron rails, Chicago....	\$18.00	\$18.00	\$18.50	\$12.25
Iron rails, Philadelphia....	20.00	20.00	20.00	15.00
Carwheels, Chicago....	12.00	12.00	12.75	11.00
Carwheels, Philadelphia....	16.00	16.00	16.50	12.00
Heavy steel scrap, P'gh....	16.00	15.75	16.00	11.75
Heavy steel scrap, Phila....	14.75	14.75	16.00	11.50
Heavy steel scrap, Ch'go....	14.00	14.00	15.00	10.25
No. 1 cast, Pittsburgh....	15.75	15.75	16.00	12.25
No. 1 cast, Philadelphia....	16.00	16.00	17.50	12.25
No. 1 cast, Ch'go (net ton)	11.50	11.50	12.00	9.25

Coke, Connellsburg, Per Net Ton at Oven:

Coke, Connellsburg, Per Net Ton at Oven:				
Furnace coke, prompt....	\$2.75	\$2.40	\$2.75	\$1.75
Furnace coke, future....	2.50	2.50	2.50	1.75
Foundry coke, prompt....	3.25	3.25	3.25	2.00
Foundry coke, future....	3.50	3.50	3.50	2.25

Metals,

Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Lake copper, New York....	27.00	27.75	28.25	22.50
Electrolytic copper, N. Y....	26.50	26.50	28.00	19.75
Speier, St. Louis....	10.75	11.50	13.37 1/2	21.50
Speier, New York....	11.00	11.75	13.62 1/2	22.00
Lead, St. Louis....	6.65	6.65	6.85	5.62 1/2
Lead, New York....	6.85	6.80	7.00	5.75
Tin, New York....	39.87 1/2	39.00	44.25	39.25
Antimony, Asiatic, N. Y....	16.00	17.50	23.00	36.75
Tin plate, 100-lb. box, P'gh....	\$6.00	\$6.00	\$5.75	\$3.10

third quarter will not get deliveries before the last quarter of this year and on part of it possibly not before the first quarter of next year. The holiday this week, causing loss of operations in the coke regions, has put up the price of prompt coke. More coke contracts have been placed for last half of the year at prices ranging from \$2.35 to \$2.65 at oven, depending on the quality. Pig Iron.—There is a very active export demand for Bessemer iron, and we note one lot of 1000 tons and another of 10,000 tons closed for export to Italy, the latter iron being for delivery in the third quarter of this year, all at \$21, Valley furnace; also a sale of 2000 tons at \$21.50, Valley furnace, which was paid for spot shipment, a boat waiting at New York. The Portsmouth Steel Company, Portsmouth, Ohio, has bought 20,000 tons of basic for delivery in the last quarter from Columbus and Ironton furnaces at prices equal to about \$18, or slightly higher, at Valley furnace. We note a sale of 500 tons and one of 300 tons of Bessemer to domestic consumers at \$21, Valley furnace. The Colonial Steel Company has not yet closed on its inquiry for 10,000 tons of basic for the last half of the year, and the United Steel Company, Canton, Ohio, is in the market for 10,000 tons of basic for last half. The situation in basic is tightening; offers of \$18 have been refused in several cases. A sale of 500 tons of basic for Eastern delivery is reported at \$18.50, Valley furnace, and several other lots amounting to close to 10,000 tons, also for Eastern delivery, are in the market. We quote Bessemer iron at \$21; basic, \$18 to \$18.50; gray forge, \$17.75 to \$18; malleable Bessemer, \$18.50 to \$19, and No. 2 foundry, \$18.25 to \$18.50, all at Valley furnace, the freight rate to the Pittsburgh and Cleveland districts being 95c. per gross ton.

Ferroalloys.—There is practically no new inquiry for ferromanganese for prompt or future shipment, and prices are softer. Domestic 80 per cent for prompt delivery is quoted at \$200 to \$225, and for the last half of the year \$175 to \$200 at maker's furnace. It is not believed there will be any trouble in buying 80 per cent domestic ferromanganese at \$175 for delivery over the last half of this year. This is also the price asked for English 80 per cent at seaboard, but without any guarantee as to delivery. Prices on spiegeleisen are also easier. We quote 18 to 22 per cent spiegeleisen at \$45 to \$50, and 25 to 35 per cent at \$50 to \$55 at furnace. One maker is still offering ferrosilicon at about \$2 per ton less than the other two makers are quoting. We quote 50 per cent ferrosilicon at \$85 for lots up to 100 tons; over 100 tons and up to 600 tons, \$84, and over 600 tons, \$83, all per gross ton, f.o.b. Pittsburgh. Prices of Bessemer ferrosilicon for delivery over remainder of the year are now quoted as follows: 9 per cent, \$32; 10 per cent, \$33; 11 per cent, \$34; 12 per cent, \$35; 13 per cent, \$36.50; 14 per cent, \$38.50; 15 per cent, \$40.50, and 16 per cent, \$43. Seven per cent silvery for the same delivery is \$28.50; 8 per cent, \$29; 9 per cent, \$29.50; 10 per cent, \$30; 11 per cent, \$31, and 12 per cent, \$32. All these prices are f.o.b. at furnace, Jackson or New Straitsville, Ohio, or Ashland, Ky., each of these points having a freight rate of \$2 per gross ton to Pittsburgh.

Billets and Sheet Bars.—We can report a very heavy export demand for Bessemer and open-hearth billets, with negotiations under way involving 40,000 to 50,000 tons. This demand has taken up any slack that existed either in prices or in demand, and both Bessemer and open-hearth steel are stronger than they were early in June. Offers of \$40 per ton for Bessemer or open-hearth billets by domestic consumers have been refused, and sellers who are handling export inquiries say the lowest prices that are being quoted are \$42 to \$45, several mills holding for the higher price. A sale of 1200 tons of open-hearth sheet bars for July and August shipment is reported at about \$42 at maker's mill, and possibly 15,000 to 20,000 tons of Bessemer and open-hearth billets will be closed within a short time for export. We quote soft open-hearth billets and sheet bars at \$42 to \$45; Bessemer billets, \$40 to \$42; and Bessemer sheet bars, \$40 to \$42, maker's mill, Pittsburgh or Youngstown district. We quote forging billets at \$69 for sizes up to but not including 10 x 10 in., and for carbons up to 0.25, the regular extras being charged for larger sizes and higher carbons. Forging billets running above 0.25 and up to 0.60 carbon take \$1 extra.

Plates.—About 10,000 tons of plates and shapes will be needed for the three bulk freighters ordered recently

by M. A. Hanna & Co., Cleveland, Ohio, all of which will be furnished by the Carnegie Steel Company. The Baltimore & Ohio Railroad has withdrawn its inquiry for 1000 steel underframes, and at present there are no large inquiries for cars in the market. There is an insistent demand for plates for fairly prompt shipment, on which mills are able to get 3.25c. to 3.50c., and in some cases up to 4c. at mill. The mill price on $\frac{1}{4}$ -in. and heavier steel plates is 2.75c. for delivery in the last quarter of this year and first quarter of 1917. For shipment in four to six weeks, prices range from 3c. to 4c., at mill, depending entirely on the amount of material involved and deliveries wanted by the customer. So far as we know, only one mill is quoting 3c., all others asking 3.25c. to 4c.

Structural Material.—New inquiry is quiet. Bids have gone in on 1000 tons of shapes for an extension to Mercy Hospital in this city, but the contract has not been closed. Local fabricators are well filled up for the remainder of this year, and several are not actively bidding on the new work. We quote beams and channels up to 15 in. at 2.50c. to 2.75c. at mill for delivery in third and fourth quarters, while small lots from stock are held at 3.25c. up to 4c., prices depending entirely on the size of the order and how soon deliveries are wanted.

Steel Rails.—The Havana Central Railroad of Cuba has placed 800 tons of standard sections with the Steel Corporation, and it is assumed these will be rolled at the local mill. New orders for standard section rails are small. Inquiry for light rails is only fair, coming mostly from the coal-mining interests, the traction companies doing very little. It is said a good part of the new business in light rails is going to the rerolling mills, which are naming lower prices than the mills making new light rails. We quote 25 to 45-lb. sections at \$47; 16 and 20-lb., \$48; 12 and 14-lb., \$49, and 8 and 10-lb., \$50 in carload lots, f.o.b. at mill, the usual extras being charged for less than carload lots. We quote standard section rails of Bessemer stock at 1.47 $\frac{1}{2}$ c. and of open-hearth, 1.56 $\frac{1}{2}$ c., Pittsburgh.

Sheets.—There is a further decline in prices of galvanized sheets, due to the lower spelter market, some mills naming as low as 4.50c. at mill for No. 28. One leading mill that has a number of contracts for galvanized sheets on its books at 5c. at mill, and which have no cancellation clause, is insisting that the buyers take out these sheets, and is making shipments as called for in the contracts. New demand for light black sheets is quiet, but prices are fairly strong. On blue annealed and electrical sheets most mills are sold up for the remainder of this year. The sheet mills report they are getting very prompt deliveries on Bessemer sheet bars, but there is still a scarcity in the supply of open-hearth bars. We quote blue annealed sheets, Nos. 9 and 10, at 3c. to 3.25c., for delivery at convenience of the mill, which would be late this year. We quote No. 28 Bessemer and open-hearth black sheets at 2.90c. to 3c.; No. 28 galvanized, Bessemer and open-hearth, 4.50c. to 4.60c.; Nos. 22 and 24 black plate, tin mill sizes, H. R. & A., 2.90c.; Nos. 25, 26 and 27, 3c. to 3.10c.; No. 28, 3.10c. to 3.15c., and No. 29, 3.20c. to 3.25c. These prices are for carloads and larger lots, f.o.b. mill, Pittsburgh.

Tin Plate.—There is some domestic inquiry for tin plate for last quarter delivery, but two or three of the leading mills say they cannot quote, as their entire supply is sold up for all of this year. Export demand is active, and there is no trouble getting \$6.25 to \$6.50 per base box by mills that are in position to make the deliveries wanted. A sale of 5000 boxes for China was made recently at \$6.20 per base box at mill. We quote wasters from stock at \$5.75 and primes at \$6 for the domestic trade, while for export \$6.25 to \$6.50 per base box at mill is quoted. We quote 8-lb. coated ternes at \$8.50 to \$8.75 for 200 lb., and \$8.75 to \$9 for 214 lb., all f.o.b. at maker's mill.

Skelp.—New inquiry is quieter, but the two or three local mills that roll skelp say they are pretty well filled up for the remainder of this year. Prices are firm. We quote grooved steel skelp at 2.35c. to 2.40c.; sheared steel skelp, 2.45c. to 2.50c.; grooved iron skelp, 2.70c.

to 2.80c., and sheared iron skelp, 3c. to 3.10c., all delivered to consumers' mills in the Pittsburgh district.

Cold-Rolled Strip Steel.—Nearly all consumers have covered their needs for the remainder of this year, and the demand on contracts is quiet. One contract was placed last week for 500 tons for last half delivery at 6c. per lb. base, f.o.b. Pittsburgh. Small lots for shipment in the next two or three months bring \$6.50 to \$7 per 100 lb. On contracts we quote cold-rolled strip steel at \$6 per 100 lb., base, and on small lots for fairly prompt delivery, from \$6.50 to \$7. Extras, standard with all the mills, were printed in full on page 810 of THE IRON AGE of March 30.

Railroad Spikes.—The local market is very quiet, and there are no active inquiries, the railroads being covered for the remainder of this year. Regular prices, which are only fairly strong, and which have been shaded in one or two cases lately, are as follows:

Standard railroad spikes, $4\frac{1}{2}$ x 9/16 in. and larger, \$2.65 to \$2.75; railroad spikes, $\frac{1}{2}$ and 7/16 in., \$2.75 base; railroad spikes, $\frac{3}{8}$ in. and 5/16 in., \$3.05 base; boat spikes, \$2.80 base, all per 100 lb., f.o.b. Pittsburgh.

Nuts and Bolts.—The new domestic demand is quiet, as consumers are covered over the remainder of the year. Specifications are coming in quite freely, but in a few cases some consumers are not specifying for the full amount called for in contracts. Export inquiry is quiet, but nut and bolt makers report they have their output pretty well sold up over the next three or four months. Discounts in effect from May 19, which the makers state are for prompt acceptance only, are as follows, delivered in lots of 300 lb. or more where the actual freight rate does not exceed 20c. per 100 lb., terms 30 days net, or 1 per cent for cash in 10 days:

Carriage bolts, small, rolled thread, 50 and 10 per cent; small, cut thread, 50; large, 40.

Machine bolts, h. p. nuts, small, rolled thread, 50, 10 and 5 per cent; small, cut thread, 50 and 5; large, 40 and 10.

Machine bolts, e. p. c. and t. nuts, small, 40, 10 and 5 per cent; large, 35 and 5. Blank bolts, 40 and 10 per cent; bolt ends with h. p. nuts, 40 and 10; with c. p. nuts, 35 and 5. Rough stud bolts 15. Lag screws (cone or gimlet point), 50 and 10.

Forged set screws and tap bolts, 10 per cent. Cut and round point set screws, case hardened, 60. Square and hexagon head cap screws, 55. Flat, button, round or fillister head cap screws, 30.

Nuts, h. p. sq. tapped or blank, \$2.90 off list; hex., \$2.90 off; e. p. c. and t. sq. tapped or blank, \$2.60 off; hex., \$3 off; semi-finished hex., 60 and 10 per cent; finished and case hardened, 60 and 10.

Rivets, 7/16 in. in diameter and smaller, 45, 10 and 10 per cent.

Wire Rods.—New demand is quiet, as consumers are covered over the remainder of the year and, in fact, there are very few surplus rods being offered in the open market. We quote soft Bessemer, open-hearth and chain rods at \$50 to \$55 per ton, f.o.b. Pittsburgh.

Wire Products.—The expected advance in prices on wire and wire nails about July 1 was not made. The new demand is only fair, as the wire trade is now in the dull season. Mills report specifications against contracts of domestic consumers as fairly active, while the export demand for barb wire is still very heavy. The regular price of wire nails is \$2.50 base per keg, but in some cases \$2.60 is being obtained for delivery later in third quarter and fourth quarter of this year. Regular prices are as follows: Wire nails, \$2.50 to \$2.60 per keg; galvanized, 1 in. and longer, taking an advance over this price of \$2, and shorter than 1 in., \$2.50. Plain annealed wire, \$2.45 per 100 lb.; galvanized wire, \$3.15; galvanized barb wire and fence staples, \$3.35; painted barb wire, \$2.65; polished fence staples, \$2.65; cement coated nails, \$2.50, base, all f.o.b. Pittsburgh, with freight added to point of delivery, terms 60 days net, less 2 per cent off for cash in 10 days. Discounts on woven wire fencing are now 61 $\frac{1}{2}$ per cent off list for carload lots, 60 $\frac{1}{2}$ per cent for 1000-rod lots and 59 $\frac{1}{2}$ per cent for small lots, f.o.b. Pittsburgh.

Iron and Steel Bars.—It is stated that quite a few large contracts for steel bars for delivery in first half of next year have been closed by leading implement makers on the basis of 2.50c. at mill. In fact, two of the largest makers of steel bars say that in no case will they shade this price, as they will put the steel into

other forms of products if they are not able to sell their full output of steel bars. Specifications against contracts are active and no cancellations are reported. In a few cases consumers are not taking out the full amount of steel bars called for in their contracts. The new demand for iron bars is only fair and prices are none too firm. We quote steel bars at 2.50c. by local mills for delivery probably not before last quarter, and also 2.50c. from one mill which is promising deliveries in four to six weeks. Small lots from warehouse are quoted at 3c. and higher, depending on quantity. We quote refined iron bars at 2.50c. to 2.60c., and railroad test bars at 2.70c. to 2.80c. at mill.

Rivets.—Makers report the new demand as quieted down, due largely to the fact that consumers are covered over the remainder of the year. Specifications are active and there is a fair amount of export inquiry. Makers' prices, which are sometimes shaded by jobbers, are as follows: Buttonhead structural rivets, $\frac{1}{2}$ in. in diameter and larger, at \$4 per 100 lb., base, and cone-head boiler rivets, same sizes, \$4.10 per 100 lb., base, f.o.b. Pittsburgh. Terms are 30 days net, or one-half of 1 per cent for cash in 10 days.

Shafting.—Most of the buying of shafting in large quantities for this year has been done, nearly all consumers being covered on their needs for last half at about 20 per cent off, but on a few contracts 15 per cent was done. Makers say they have their output well sold up for the remainder of the year. We quote cold-rolled shafting at 20 to 15 per cent off in carload lots for delivery in last quarter of this year and first quarter of 1917, and 10 per cent off in less than carload lots, f.o.b. Pittsburgh, freight added to point of delivery.

Cotton Ties.—It is said that most of the business in cotton ties for this year will be done during July, as nearly all consumers will cover this month for their entire needs. We quote cotton ties at \$1.35 per bundle of 45 lb., f.o.b. Pittsburgh for July shipment. It is stated that the Sharon Steel Hoop Company, Sharon, Pa., will not make any cotton ties this year.

Hoops and Bands.—Consumers are well covered over the remainder of the year and new demand is quiet. We quote steel hoops at 2.75c. and steel bands at 2.50c., with extras on the latter as per the steel-bar card.

Merchant Steel.—Shipments by the mills are heavy against contracts, but new demand is dull, as nearly all consumers are covered over the remainder of the year. Prices on small lots are about as follows: Iron-finished tire, $\frac{1}{2} \times 1\frac{1}{2}$ in. and larger, 2.35c., base; under $\frac{1}{2} \times 1\frac{1}{2}$ in., 2.50c.; planished tire, 2.55c.; channel tire, $\frac{3}{4}$ to $\frac{5}{8}$ and 1 in., 2.85c. to 2.95c.; $1\frac{1}{2}$ in. and larger, 3.25c.; toe calk, 2.95c. to 3.05c., base; flat sleigh shoe, 2.70c.; concave and convex, 2.75c.; cutter shoe, tapered or bent, 3.25c. to 3.35c.; spring steel, 2.95c. to 3.05c.; machinery steel, smooth finish, 2.75c.

Wrought Pipe.—Reports are that a Youngstown mill has taken a contract for 140 miles of 6 and 8 in. line pipe for an Oklahoma oil interest, and that another larger contract from the same buyer will shortly be placed. The general demand for merchant pipe is fair but for oil country goods is very heavy. On lap-weld pipe, mills are well sold up for the remainder of the year, but on butt-weld sizes they can make delivery in two to three weeks. The demand for galvanized pipe is light, but all the mills are running full, and turning out more pipe and making the heaviest shipments ever made in their history. Discounts on iron and steel pipe, printed on another page, are firmly held.

Boiler Tubes.—On merchant and boiler tubes mills are well sold up for the remainder of the year, and on seamless tubing into the first half of next year. Some large contracts for boiler tubes for locomotives placed by Russia in this country have been given to local makers. Discounts on iron and steel boiler tubes, printed on another page, are very firm.

Coke.—A holiday this week and the consequent falling off in output will make a shortage in supply, and, as a result, there is quite a flurry in prompt furnace coke, consumers offering up to \$2.75 per net ton at oven. There have been some contracts closed for blast-furnace coke for shipment over the last half of the

year. A Shenango Valley furnace interest has bought 10,000 tons of high-grade coke for July and August at \$2.50 per net ton at oven. Two Eastern furnace interests have closed for their needs, one taking about 8000 tons and another about 10,000 for the last half of the year at about \$2.35 at oven, this coke usually selling at slightly less than the regular market. A Shenango Valley furnace interest closed last week for high-grade coke, 10,000 tons, for delivery over the last half at \$2.65 at oven. A consumer in the Wheeling district has closed for a large quantity of furnace coke for July and August shipment at about \$2.50 at oven. Prices on furnace coke on contracts for over the last half of the year range from \$2.35, the lowest, up to \$2.65, which has been paid in three different cases for high-grade coke. We quote prompt furnace coke at \$2.75 at oven. We quote 72-hr. foundry coke at \$2.75 to \$3 for prompt and \$3 to \$3.25 on contracts for the last half of the year. The Connellsville *Courier* gives the output of coke in the upper and lower Connellsville regions for the week ended June 24 as 417,540 net tons, a decrease over the previous week of 10,733 tons.

Old Material.—There has been quite an improvement in the local scrap market, due to the heavy buying of the leading interest, which has been out of the market for two months or more. This largest consumer is reported to have taken from 75,000 to 100,000 tons of heavy steel scrap at prices ranging from \$16, the lowest, up to probably \$16.50 per gross ton. There has also been buying of scrap by consumers in Massillon and Canton, Ohio, and by the leading consumer at Sharon, Pa. A heavy demand has developed for old carwheels, and prices are strong. They are being bought by open-hearth steel plants, broken up, and used as heavy steel scrap and to replace basic iron, a shortage in which is feared as a result of the strike in the ore regions. Dealers are now quoting for delivery in the Pittsburgh and nearby districts that take the same rates of freight, per gross ton, as follows:

Heavy steel melting scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen, Midland and Pittsburgh, delivered	\$16.00 to \$16.50
No. 1 foundry cast.....	15.75 to 16.00
Rerolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	16.50 to 16.75
Hydraulic compressed sheet scrap..	14.50 to 14.75
Bundled sheet scrap, sides and ends, f.o.b. consumers' mills, Pittsburgh district	12.50 to 12.75
Bundled sheet stamping scrap.....	11.50 to 11.75
No. 1 railroad malleable stock.....	14.00 to 14.25
Railroad grate bars	11.00 to 11.25
Low phosphorus melting stock.....	19.00 to 19.50
Iron car axles	25.50 to 26.00
Steel car axles	26.00 to 26.50
Locomotive axles, steel	28.00 to 28.50
No. 1 busheling scrap	13.25 to 13.50
Machine-shop turnings	8.25
Old carwheels	14.00 to 14.50
Cast-iron borings	8.25
Sheet bar crop ends	16.00 to 16.50
No. 1 railroad wrought scrap	18.75 to 19.00
Heavy steel axle turnings	12.00 to 12.25
Heavy breakable cast scrap.....	13.50 to 13.75

*Shipping point.

Philadelphia

PHILADELPHIA, PA., July 3, 1916.

The Independence Day holiday was so extensively observed that there was little opportunity for developments of moment. Some executive and sales offices attempted no business between noon Saturday and the morning of July 5, while others were open only long enough on Monday morning to dispose of urgent mail. In many cases the extra holiday was welcomed as affording some relief from the strain of recent months. In general, comment on conditions made a week ago can be reiterated. The foreign demand for certain grades of pig iron continues to grow, while the domestic market remains quiet, with prices weak and concessions possible to find. The export demand for steel plates is heavy also, while the domestic demand is unabated. Bessemer bars are available at 2.65c., Philadelphia, and Bessemer shapes at 2.90c. Old material has a better tone in sympathy with Pittsburgh, but actual betterment in prices has not arrived.

Pig Iron.—The only domestic inquiry of notable size

before the trade is one for 4500 tons of basic required by a Lebanon interest. The volume of foreign inquiries for low phosphorus and special and standard Bessemer continues to grow, although it appears greater than it really is because of duplication. At the same time the amount of iron required for export, especially to Italy, is very large. For standard low phosphorus export prices range from \$34 to \$35, seaboard. Though June was accounted a quiet month, so far as domestic business was concerned, some sellers are surprised at the excellent aggregate which was done. Prompt deliveries, with some through the second half, were called for chiefly. The past week has been quiet. Several of the larger producers continue to quote \$20, furnace, as their minimum for eastern Pennsylvania, No. 2 X, but the fact remains that considerably below this figure can be done without difficulty. There are some furnaces which seem to want business, and the resale or speculative iron which has been on the market for some time is not entirely absorbed, although it is believed to be nearing its end. In this connection there is a phase of the situation which has not been generally considered in regard to consumption, and this is the fact that melters have not only been taking a large part of current production, but also have been using up the iron which was bought by speculators or investors months ago when prices were at the bottom, all of which speaks well for consumption. The attitude of some important interests with regard to prices is that the producers should not endeavor to meet the quotation made by these outside interests, inasmuch as if they do the resellers will only cut deeper, and presumably get the business anyway. It is argued that with the producers in the comfortable position in which they find themselves to-day they should stand firmly for the prices which eventually must be met, unless consumption collapses, an exigency of which there is no indication at this time. Meanwhile, No. 2 X can be obtained at \$19.75, delivered, and it is more than probable that this price could be shaded. The situation is somewhat irregular, for the reason that while some consumers appear to have underestimated their requirements, others have been oversupplied because of the shortage of labor, the latter being the case with a stove foundry whose molders are twelve under the normal quota. In no grade is there any change in quotations to report. Quotations for standard brands, delivered in buyers' yards, prompt shipment, range about as follows:

Eastern Pa., No. 2 X foundry.....	\$19.75 to \$20.25
Eastern Pa., No. 2 plain.....	19.50 to 20.00
Virginia, No. 2 X foundry.....	21.25
Virginia, No. 2 plain.....	20.75
Gray forge	18.50 to 19.00
Basic	19.50 to 20.00
Standard low phosphorus	33.00 to 34.00

Iron Ore.—The only arrival of foreign ore in the week ended July 1 consisted of 7700 tons from Cuba.

Ferroalloys.—Domestic 80 per cent ferromanganese is weaker, a fact indicated by prices accepted for comparative small lots. Whereas \$225, seaboard, has been quoted for prompt by domestic makers, a bid of 9½c. per pound, delivered at Colon, was made on 5 tons required by the Government at the Panama Canal and, inasmuch as a freight rate of about \$6 per ton is involved, it means that a price of about \$206.80 was acceptable in this case. For 7 tons to be delivered at Washington, 9½c. per pound was named also. On an inquiry for 10 tons, delivery at Buffalo, 10c. per pound, or \$224, less freight, was quoted. All these involved prompt deliveries. For the last quarter of this year and first quarter of next, \$175, seaboard, can be done. For spiegelsisen \$58 to \$60 is quoted. Contract ferrosilicon, 50 per cent, is unchanged at \$83 to \$85, Pittsburgh, according to quantity, and 11 per cent at \$35.44.

Plates.—Many thousands of tons of plates for export are under inquiry, and the demand from domestic sources shows no abatement. One mill turned down an order for 6000 tons for first quarter delivery, although the price was admittedly satisfactory, for the reason that it cannot handle an order of such size this side of next April. This mill continues to quote 4c., Pittsburgh, as its minimum, equal to 4.15c., Philadelphia. The Pusey & Jones Company, Wilmington, Del., which re-

cently passed into the hands of Norwegian interests, is reported to have additional orders for twelve ships, six to be 225 ft. in length and six to be 300 ft. It had eight vessels under construction. Quotations are uniformly 4.15c., Philadelphia, except with one maker whose sizes are limited. He quotes 3.90c., Philadelphia.

Bars.—Bessemer bars are obtainable at 2.65c., Philadelphia, but open-hearth bars range about 1c. higher. Contracts for the last half have been made at the 2.65c. level. Contracts for open-hearth bars were booked at the same figure, but deliveries in these cases are understood to be indefinite.

Structural Material.—No improvement in new business is reported, but specifications keep the mills fully employed. The quarter just entered will bring the specifying of much material which will cost 2.65c., Philadelphia, and upward. How far the higher cost of materials will curtail specifications remains to be seen. Bessemer shapes can be had at 2.90c., Philadelphia, but eastern Pennsylvania makers adhere to 3.15c. for their open-hearth material.

Billets.—Steel is no easier to obtain than it was several months ago, and there is much hunting around by consumers. A Lebanon consumer is inquiring for 1500 tons of small billets, and round lots are wanted for export also. The quotation for open-hearth re-rolling steel is unchanged at \$50, and that for forging steel at \$65.

Sheets.—On attractive contracts, 3.15c., Philadelphia, or close thereto, is acceptable for No. 10 blue annealed sheets. For prompt deliveries up to 3.90c., Philadelphia, is asked.

Coke.—The quantity of furnace coke stated to have been taken by an eastern Pennsylvania furnace a week ago was about 60,000 tons, instead of 17,000 to 20,000 tons. Some furnace coke has been sold for export at about the ruling domestic prices. Prompt furnace ranges from \$2.40 to \$2.60 per net ton at oven, and contract at \$2.25 to \$2.35. Prompt foundry is quoted at \$3.25 to \$3.50, and contract at \$3.35 to \$3.50 per net ton at oven. Freight rates from the principal producing districts are as follows: Connellsville, \$2.05; Latrobe, \$1.85, and Mountain, \$1.65.

Old Material.—There is a better feeling in the market, based on the higher prices which have been paid for material in the Pittsburgh district, and within a few days higher prices are looked for here. As yet, however, there has not been a sufficient increase in business to justify any advance in local quotations. There is a good demand for low phosphorus crop ends for export to Italy. They are quoted at \$22.50 to \$23.25. Quotations for delivery in buyers' yards in this district, covering eastern Pennsylvania, and taking freight rates from 35c. to \$1.35 per gross ton, are as follows:

No. 1 heavy melting steel.....	\$14.75 to \$15.25
Old steel rails, rerolling.....	17.00 to 18.00
Low phos. heavy melting steel scrap	20.50 to 21.50
Old steel axles	26.00 to 27.00
Old iron axles	28.00 to 29.00
Old iron rails	20.00 to 20.50
Old carwheels	16.00 to 16.50
No. 1 railroad wrought	19.50 to 20.00
Wrought-iron pipe	12.50 to 13.00
No. 1 forge fire	13.00 to 13.50
Bundled sheets	13.00 to 13.50
No. 2 busheling	10.50 to 11.00
Machine shop turnings	8.50 to 9.00
Cast borings	10.00 to 10.50
No. 1 cast	16.00 to 16.50
Grate bars, railroad	11.75 to 12.25
Stove plate	11.75 to 12.25
Railroad malleable	13.50 to 14.00

The war's effect on Argentina's consumption of iron is demonstrated by that country's imports of pig iron and steel for 1915 of only 203,805 metric tons. This is more than 50 per cent less than the imports in 1914—433,924 tons—and only one-third of those in 1913, which were 680,709 tons. Argentina imported only 2708 tons of pig iron and sheet iron last year, against 92,628 tons in 1914 and 186,576 tons in 1913. Steel-rail imports fell from 156,592 tons and 84,936 tons, in 1913 and 1914 respectively to 13,391 tons in 1915.

Cleveland

CLEVELAND, OHIO, July 4, 1916.

Iron Ore.—Lake ore shipments have finally passed the 9,000,000-ton mark. The movement in June amounted to 9,507,576 gross tons, and for the second time this year a new record in shipments was made. In May the movement was 8,449,580 gross tons, passing the previous high record of 8,206,416 tons in July, 1913. The June movement was a gain of nearly 60 per cent over June, 1915, when the Lake shipments amounted to 6,005,091 tons. The total of shipments by water this season up to July 1 was 19,615,567 tons, a gain of 8,094,284 tons over the corresponding period a year ago. We quote prices as follows, delivered lower Lake ports: Old range Bessemer, \$4.45; Mesaba Bessemer, \$4.20; old range non-Bessemer, \$3.70; Mesaba non-Bessemer, \$3.55.

Pig Iron.—The market is unusually dull. Labor troubles and the scarcity of labor are affecting foundry production. While these so far have not resulted in holding up shipments to any extent, they doubtless have affected the demand for iron for additional requirements. The only inquiry of any size is from a Lima, Ohio, consumer for 2000 tons of Southern iron for the last half. In the absence of buying, Ohio furnaces generally are adhering to the recent quotation of \$18.50, at furnace, for No. 2, and it is not known whether the low price on Southern iron will affect the prices on Northern grades, although some purchasers are not disposed to meet this competition. Southern iron is quoted by furnaces at \$14.50, Birmingham, for No. 2 for the last half and \$14.50 to \$15 for the first half, with resale iron offered at \$13.50 to \$14. Prices on Ohio silvery iron are being shaded somewhat, but not sufficiently to meet the low prices of Tennessee furnaces. We quote, delivered Cleveland, as follows:

Bessemer	\$21.95
Basic	18.95
Northern No. 2 foundry	\$18.70 to 19.00
Southern No. 2 foundry	18.00 to 18.50
Gray forge	18.50
Jackson Co. silvery, 8 per cent. silicon	28.62 to 30.62
Standard low phos., Valley furnace	32.00

Coke.—The market is lifeless. Foundries are practically all under contract and there is little demand for prompt shipment coke. We quote standard Connellsville foundry coke at \$3 to \$3.25, per net ton at oven, for prompt shipment and \$3.25 to \$3.50 for contracts.

Finished Iron and Steel.—The demand is more active than in the past two or three weeks. Considerable business, either for early delivery or in third or fourth quarter contracts, is being placed. A large rivet maker has closed for a round tonnage of bars for the first quarter of next year. The American Shipbuilding Company has taken a foreign order for two boats of the Welland Canal size, and the steel for these boats and the three ore boats recently ordered, amounting to 12,800 tons, has been placed with the Carnegie Steel Company. Contracts are being placed for steel bars for the third quarter at 2.50c., Pittsburgh, and for structural material at 2.50c. to 2.75c. for the third quarter or for delivery at convenience of the mills. Bessemer steel bars are quoted at 2.50c., Pittsburgh, for early shipment. Plates are in good demand but very firm at 3.50c. to 4c., Pittsburgh, for early delivery and 2.90c. for delivery at convenience of the mills. One Ohio consumer has just closed for 1000 tons of boiler and tank plates for third quarter delivery at 4c. There is considerable demand for semi-finished steel for third quarter delivery, with a rather wide spread in quotations. We note a sale of 700 tons of open-hearth sheet bars at \$40 by a Pittsburgh mill to an Ohio consumer, and a sale of 1000 tons of open-hearth slabs at \$43, Youngstown, to a Cleveland mill for early shipment. Forging billets are being sold at \$65 at mill. Bar iron is unchanged at 2.50c., Cleveland, and hard steel bars at 2.25c., Western mill. New demand for sheets is only fairly active, and several Ohio mills are in better shape on deliveries than they have been for some time. We quote sheets at 2.90c. to 3c., Ohio mill, for No. 28 black; 3c. to 3.25c. for No. 10 blue annealed, and 4.50c. to 4.65c. for No. 28 galvanized. Local warehouse business showed some falling off during June as compared with May, this being attributed

to the fact that jobbers' stocks are badly depleted. Warehouse prices are unchanged at 3.25c. for steel bars and structural material, 3.65c. for plates and 3.20c. for iron bars.

Old Material.—The market is dull and weak. Heavy melting steel has declined \$1 per ton in Cleveland. Some tonnage was sold late last week to local mills at \$14.50, but these consumers have reduced their offer to \$14, and sales to dealers have been made at the latter price. Old carwheels sold by the Nickel Plate Railroad late in the week brought only \$12, or considerably less than recent quotations. Busheling has further declined 50c. per ton, some on track being sold to a local mill at \$11 per net ton. The production of scrap continues in excess of the demand, and the lower prices are not stimulating buying. Youngstown and Sharon mills are holding back on shipments. We quote, f.o.b. Cleveland, as follows:

	Per Gross Ton
Steel rails	\$14.00 to \$14.25
Iron rails	18.50 to 19.00
Steel car axles	28.00 to 29.00
Heavy melting steel	14.00 to 14.25
Carwheels	12.00
Relaying rails, 50 lb. and over	22.50
Agricultural malleable	12.50 to 12.75
Railroad malleable	14.00 to 14.25
Steel axle turnings	12.00 to 12.25
Light bundled sheet scrap	12.00 to 12.25

	Per Net Ton
Iron car axles	\$23.00 to \$24.00
Cast borings	5.75 to 6.00
Iron and steel turnings and drillings	5.75 to 6.00
No. 1 busheling	11.00 to 11.50
No. 1 railroad wrought (nominal)	15.00 to 15.50
No. 1 cast	14.00 to 14.25
Railroad grate bars	9.00 to 9.50
Stove plate	10.00 to 10.25

Bolts, Nuts and Rivets.—There is some improvement in the new demand for bolts and nuts, which has been rather quiet for a few weeks. Prices are firm. Rivet specifications are not so heavy as they have been, but there is considerable contracting for third quarter and last half. Manufacturers' prices are firm, but jobbers are shading prices \$1 to \$2 per ton for prompt shipment. We quote rivets at 4c., Pittsburgh, for structural and 4.10c. for boiler rivets. Bolt and nut discounts are as follows:

Common carriage bolts, $\frac{1}{4}$ x 6 in., smaller or shorter, rolled thread, 50 and 10; cut thread, 50; larger or longer, 40; machine bolts with h. p. nuts, $\frac{1}{4}$ x 4 in., smaller and shorter, rolled thread, 50, 10 and 5; cut thread, 50 and 5; larger and longer, 40 and 10; lag bolts, gimlet or cone point, 50 and 10; square h. p. nuts, blank or tapped, \$2.90 off the list; hexagon, h. p. nuts, blank or tapped, \$2.90 off; c. p. c. and t. square nuts, blank or tapped, \$2.60; hexagon nuts, all sizes, \$3 off; cold pressed semi-finished hexagon nuts, all sizes, 60 and 10.

Buffalo

BUFFALO, N. Y., July 3, 1916.

Pig Iron.—Sales have been moderate, totaling somewhat less than 4000 tons of all grades. Inquiry has been for small lots only and for last half delivery. Foundrymen find themselves unable to put out the full measure of production they had anticipated, on account of the shortage of labor. This situation has resulted in carrying over iron intended for first-half use. Requirements for the immediate future are accordingly uncertain, pending the adjustment of these labor conditions. There has been no change in the price schedule, which we quote as follows, f.o.b. furnace, Buffalo, for last-half delivery:

No. 1 foundry	\$19.00 to \$19.50
No. 2 X foundry	18.50 to 19.50
No. 3 plain	18.50 to 19.00
No. 3 foundry	18.50 to 18.75
Gray forge	18.50
Malleable	18.50 to 19.50
Basic	19.50 to 20.00
Bessemer	21.00 to 22.00
Charcoal, regular brands and analysis	21.00 to 22.00

Finished Iron and Steel.—Some checks to shipment are noted, due to mill labor conditions. New business is comparatively light. A considerable amount of concrete reinforcing bars for the Niagara Alkali Company, Niagara Falls, is before the market. In structural lines, bids have been asked for 400 tons for the Bank of Buffalo; for 100 tons for the Buffalo Foundry & Machine Company, and for a fair quantity for the Titanium

Alloy Mfg. Company at Niagara Falls. The Buffalo Structural Steel Company has a contract for 200 tons for the International Acheson Graphite Company, Niagara Falls, and for 700 tons for the new buildings for the Wickwire Steel Company.

Old Material.—The embargo has been removed by one of the largest consumers of scrap material in the Pittsburgh and Valley district, which noticeably helps the situation, particularly as regards heavy melting steel, which is now in good demand. Numerous inquiries have been received within the past few days, and dealers state that it looks as though a buying movement has been started. We quote dealers' asking prices, per gross ton, f.o.b. Buffalo, as follows:

Heavy melting steel	\$15.50 to \$16.00
Low phosphorus steel	20.00 to 20.50
No. 1 railroad wrought scrap	17.25 to 17.75
No. 1 railroad and machinery cast scrap	15.50 to 16.00
Steel axles	24.00 to 24.50
Iron axles	24.00 to 24.50
Carwheels	13.00 to 13.50
Railroad malleable	15.00 to 15.50
Machine shop turnings	6.25 to 6.75
Heavy axle turnings	12.00
Clean cast borings	7.25 to 7.75
Iron rails	18.00 to 18.50
Locomotive grate bars	11.50 to 12.00
Stove plate (net ton)	11.00 to 11.50
Wrought pipe	12.00 to 12.50
Bundled sheet scrap	11.50 to 12.00
No. 1 busheling	13.00 to 13.50
No. 2 busheling	11.00 to 11.50
Bundled tin scrap	15.00 to 15.50

Birmingham

BIRMINGHAM, ALA., July 3, 1916.

Pig Iron.—What the future will bring forth is more interesting to iron makers than what the present is. The stagnation in sales has reached a point where so little is done that no one ventures to say what the market basis really is. Small orders are being booked from carload lots to a few hundred tons for domestic use and now and then an order for export is received. The domestic business is for current and rush needs, on which \$15 is paid. No large domestic buyer is even suggesting business. If there was a chance to book as much as 20,000 tons, recessions would be made to take it. How deep the maker would cut below \$15 cannot be forecasted. The export business is sporadic. One lot of 3000 tons, two of 1000 tons each and, during the past week, one of 500 tons, were booked in June. Makers do not say at what price. There is an inquiry for as much as 10,000 tons for export, but ocean rates are so high that no large business can yet be foreseen. The lowest rate recently offered was over \$25. What to do with the proposed increase in production is another factor. The Woodward Iron Company has put in one stack on basic and the Woodstock furnace at Anniston will surely resume around July 15. Two other stacks are scheduled for July 15 and Sept. 1. Stocks, up to June 1, had not climbed sufficiently to create pessimism, but if something does not happen soon and orders still cease to come in, the present state of production will pile up iron in no inconsiderable quantity, to say nothing of the coming in of additional stacks. The hope lies in basic and the export business. Meanwhile, both buyer and maker are content to wait until after the holiday before trying out each other for the next fall. Quotations remain unchanged. We quote, per gross ton, f.o.b. Birmingham district furnaces, as follows:

No. 1 soft and foundry	\$15.25 to \$15.50
No. 2 soft and foundry	14.75 to 15.00
No. 3 foundry	14.25 to 14.50
No. 4 foundry	14.00 to 14.25
Gray forge	13.75 to 14.00
Basic	14.75 to 15.00
Charcoal	22.00 to 22.50

Coal and Coke.—The coal market is in the midst of its summer dullness. Several cargoes of Warrior River coal have been shipped in ocean-going barges to Havana and Key West, a new business that appears to be a success. The railroads are taking a fair quantity of coal. Standard beehive foundry coke is selling to the extent of manufacture at \$4.25 to \$4.50 per net ton, f.o.b. oven. The demand for furnace coke was slightly increased recently by the Anniston furnace, which is to resume soon and is securing supplies from independent makers.

Cast-Iron Pipe.—The pipe market is rather inactive, the orders coming in being just about sufficient to justify keeping up the same pace in manufacture. Southern municipalities are heard from very little. There is enough stability in the demand to maintain prices. We quote, per net ton, f.o.b. pipe shop yards, as follows: 4-in., \$28; 6-in., \$25, with \$1 added for gas pipe and 16-ft. lengths.

Old Material.—The market remains soft and will be so until consumers' yards are less gorged with stocks. Better business after the holiday is expected. Activity in steel plants is indicated for the rest of the year, and this means that scrap will catch up in the long run. Dealers are inclined to hang on to stocks on hand rather than yield to the temptation to part with them at low prices. We quote, per gross ton, f.o.b. dealers' yards, as follows:

Old steel axles	\$24.00 to \$25.00
Old steel rails	11.00 to 11.25
No. 1 steel scrap	9.50 to 10.00
No. 1 wrought scrap	13.00 to 13.50
No. 1 cast scrap	11.00 to 11.50
Extra heavy cast scrap	9.50 to 10.00
Stove plate and light	10.00 to 10.50
Old carwheels	10.50 to 11.00
Tram carwheels	9.50 to 10.00

St. Louis

ST. LOUIS, MO., July 3, 1916.

Pig Iron.—Buying has been confined to small lots for immediate or special needs. Owing to the unsettling tendency of the resale iron of the market, buyers, some of whom are understood to be ready to make purchases, are not disposed to put out inquiries or to close any transactions of moment. Furnace representatives hold that there is relatively little of the resale iron. Some interest is attaching to the expected blowing in of the furnace here of the Mississippi Valley Iron Company, which will get its ores from various sources. Owing to delays in the rehabilitation of the old St. Louis blast furnace, which will form the first unit, it is not now expected that the furnace will blow in before July 15.

Old Material.—No business is being transacted, and therefore the quotations made are really no more than estimates of value. No scrap material is being taken in by rolling mills, foundries or steel plants and rejections continue extremely severe. Owing to the succession of holidays, the usual first of the month lists will not appear until later in the week. Relaying rails continue the only strong feature of the second-hand material market; they are scarce and in good demand. In general scrap dealers are not even trading among themselves, so dull is the market. We quote dealers' prices f.o.b. customer's works, St. Louis industrial district, as follows:

Per Gross Ton	
Old iron rails	\$16.25 to \$16.75
Old steel rails, rerolling	15.25 to 15.75
Old steel rails, less than 3 ft.	15.75 to 16.25
Relaying rails, standard section, subject to inspection	22.00 to 23.00
Old carwheels	11.25 to 11.75
No. 1 railroad heavy melting steel scrap	14.50 to 15.00
Heavy shoveling steel	12.50 to 12.75
Frogs, switches and guards cut apart	14.25 to 14.75
Bundled sheet scrap	9.25 to 9.75

Per Net Ton	
Iron angle bars	\$15.25 to \$15.75
Steel angle bars	12.75 to 13.25
Iron car axles	22.75 to 23.25
Steel car axles	23.50 to 24.00
Wrought arch bars and transoms	18.50 to 19.00
No. 1 railroad wrought	14.00 to 14.50
No. 2 railroad wrought	13.75 to 14.25
Railroad springs	13.25 to 13.75
Steel couplers and knuckles	13.25 to 13.75
Locomotive tires, 42 in. and over, smooth inside	18.25 to 18.75
No. 1 dealers' forge	10.25 to 10.75
Mixed borings	5.50 to 6.00
No. 1 busheling	11.50 to 12.00
No. 1 boilers, cut to sheets and rings	8.00 to 8.50
No. 1 railroad cast scrap	11.00 to 11.50
Stove plate and light cast scrap	8.25 to 8.75
Railroad malleable	10.50 to 11.00
Agricultural malleable	9.50 to 10.00
Pipes and flues	9.50 to 10.00
Railroad sheet and tank scrap	9.00 to 9.50
Railroad grate bars	8.25 to 8.75
Machine shop turnings	6.75 to 7.00

Finished Iron and Steel.—Reports show that there are no heavy lots in the yards of the fabricators, who regard the continuing outlook good. Business out of

warehouse is active at firm prices, and up to the capacity of the shipping departments. On stock out of warehouse we quote as follows: Soft steel bars, 3.15c.; iron bars, 3.10c.; structural material, 3.15c.; tank plates, 3.50c.; No. 10 blue annealed sheets, 3.30c.; No. 28 black sheets, cold rolled, one pass, 3.30c.; No. 28 galvanized sheets, black sheet gage, 5.55c.

Coke.—The smelter inquiry for 36,000 tons reported last week has not been closed, but will be divided in all probability among Virginia and Connellsville ovens and the local by-product plant, according to present indications.

Cincinnati

CINCINNATI, OHIO, July 3, 1916.

Pig Iron.—As far as the local market is concerned, buying is almost at a standstill. A few small lots of Southern iron have been taken lately by nearby consumers for prompt shipment. In Indiana several sales of Southern foundry are reported, the largest of which is 300 tons. Southern resale prices are weak, although it was predicted that there would be a strengthening in that market after July 1, because most of the resale iron in that territory was expected to have changed hands on account of the contract stipulations for shipment in the first half. From \$14.50 to \$15 are the regular furnace quotations for last half shipment, but \$14, Birmingham basis, can be done on resale iron, and offers below \$13.50 were solicited last week. A sale of 1000 tons of malleable iron from the Ironton district was made to an Illinois consumer for last half shipment. Northern furnaces continue the quotation of \$19, Ironton, on foundry, malleable and basic for any shipment this year or in the first half of next year. Speculative foundry iron in that territory holds the prompt shipment price down to \$18.50 or lower. The Southern silvery irons are offered at a considerably lower price than the minimum asked by the Northern producers, which is \$27 at furnace for an 8 per cent analysis. The substitution of scrap iron at present costs is a matter that foundry iron sellers have to consider. Nearly all pig-iron salesmen are off the road this week. Based on freight rates of \$2.90 from Birmingham and \$1.26 from Ironton, we quote, f.o.b. Cincinnati, as follows:

Southern coke, No. 1 f'dry and 1 soft.	\$17.40 to \$18.40
Southern coke, No. 2 f'dry and 2 soft.	16.90 to 17.90
Southern coke, No. 3 foundry.	16.40 to 17.40
Southern coke, No. 4 foundry.	15.90 to 16.90
Southern gray forge.	15.40 to 16.40
Ohio silvery, 8 per cent silicon.	28.26 to 28.76
Southern Ohio coke, No. 1.	20.76 to 21.26
Southern Ohio coke, No. 2.	19.76 to 20.26
Southern Ohio coke, No. 3.	19.26 to 19.76
Southern Ohio malleable Bessemer.	19.76 to 20.26
Basic, Northern.	19.76 to 20.26
Lake Superior charcoal.	21.20 to 22.20
Standard Southern carwheel.	24.90 to 25.40

Finished Material.—Jobbers report a slackening in business, which they consider natural at this season, due, in a measure, to the cessation of building and manufacturing activities on account of the holiday. Quite a number of local firms closed their plants at Saturday noon until Wednesday of this week. Building contractors are also taking advantage of the opportunity for a midsummer vacation. While new orders for building materials are scarce, a number of contracts were made the first part of last week that will draw on warehouse stocks to a considerable extent. No price changes are noted, and we quote from stock as follows: No. 10 blue annealed sheets, 3.50c.; steel bars and small structural shapes, 3.20c.; wire nails, \$2.75 per keg, base; barb wire, \$3.60 per 100 lb.; plates, 3.50c.; smaller size machine bolts, 60 per cent off list; larger sizes, 40 and 10 and 5 per cent off; hot pressed square and hexagon nuts, 2.70c. off list; malleable washers, 5½c. per lb.; cast-iron washers, 3c. per lb.; cold-rolled rounds, 10 per cent plus list. The nearby mills quote No. 28 black sheets at 2.90c., f.o.b. Cincinnati or Newport, Ky., and No. 28 galvanized sheets at 4.90c.

Coke.—The market is very dull. Few purchases have been made of foundry coke and none is reported of furnace grades, unless a few carloads of special 48-hr. coke for domestic purposes can be taken into consideration. It is stated that while the consumption of foun-

dry coke has been reduced on account of the holiday idleness of several plants in this vicinity, the production has also been reduced in all three fields for the same reason. Connellsville furnace coke is unchanged around \$2.35 to \$2.50 per net ton at oven, and foundry coke is quoted at \$3 to \$3.50. Wise County and Pocahontas operators are selling around \$3.25 to \$3.50, and New River foundry coke is quoted at \$4 to \$4.25.

Old Material.—Quotations are unchanged, although weak at the figures named below. This applies to practically all grades of scrap. The demand is much below normal, and some dealers state that they are unable to give definite reasons for the present dullness or to predict what the near future may bring forth. The following are dealers' prices to consumers f.o.b. at yards, southern Ohio and Cincinnati:

Per Gross Ton	
Bundled sheet scrap	\$11.25 to \$11.75
Old iron rails	15.50 to 16.60
Relying rails, 50 lb. and up	21.00 to 21.50
Rerolling steel rails	14.50 to 15.00
Heavy melting steel scrap	14.00 to 14.50
Steel rails for melting	13.00 to 13.50

Per Net Ton	
No. 1 railroad wrought	\$13.25 to \$13.75
Cast borings	4.75 to 5.25
Steel turnings	5.25 to 5.75
Railroad cast scrap	11.00 to 11.50
No. 1 machinery cast scrap	12.75 to 13.25
Burnt scrap	8.25 to 8.75
Iron axles	21.00 to 22.00
Locomotive tires (smooth inside)	19.50 to 20.00
Pipes and flues	9.50 to 10.00
Malleable and steel scrap	10.75 to 11.25
Railroad tank and sheet scrap	8.50 to 9.00

Rogers, Brown & Co. have been given the agency for the by-product coke to be produced at Terre Haute, Ind., by the Indiana Gas & Coke Company. Furnace, foundry and domestic grades will be produced, commencing Sept. 1. The company's output will be about 11,000 tons per month.

San Francisco

SAN FRANCISCO, CAL., June 27, 1916.

The past month has brought a marked curtailment of business. This is due in some measure to labor troubles, ocean and river shipping having been badly tied up for several weeks; also to the vacation season, but principally to the heavy arrivals on old orders, which have placed fair stocks in the hands of merchants and regular consumers. Shipbuilders and some other large consumers with special work in hand are still short of material, and prices for prompt delivery remain very high, but the general feeling as to supplies is distinctly easier. There has been a strong tendency toward industrial expansion, but the high cost of installing plants and the uncertain attitude of labor have held this within very conservative limits. Export demand has dropped off.

Bars.—The distributive movement is lighter than for several months, as most small consumers are getting delivery on material ordered early in the year, and in many places requirements are below early estimates. Some large consumers, also, have put in small rolling outfits to work convenient forms of scrap into bars. The general movement is still quite large, however, as local mills are three to six months behind on delivery of many sizes, though little Oriental business has been taken for some time. The demand in the Orient has fallen off, partly owing to large arrivals on old orders and partly to the excessive freight rates. The jobbing price of steel bars remains at 4c., with mills quoting 3.50c. for prompt delivery to the trade, or 3c. for shipment at their convenience.

Structural Material.—While there is little conspicuous work in the market, the local shops are all quite busy on old contracts and small work, the volume of which is large in the aggregate. The largest recent letting was the theater at Fourth and Market Streets, taken by the Golden Gate Iron Works. Dyer Brothers have taken an addition to the Moana Hotel, Honolulu, 450 tons, and the McClinic-Marshall Company will fabricate 621 tons for a bridge near Sacramento, Cal.,

The general contract has been let for the projected addition to Lane Hospital. A. Huth is planning a large building on Broadway near Alder Street, Portland, Ore. The Missouri Valley Bridge & Iron Company will build two bridges for the Northern Electric Railway. Dyer Brothers have a 700-ton job for the California & Hawaiian Sugar Company, Crockett, Cal. The project for a bridge across San Francisco Bay is apparently making some progress, but the prospect of its being built in the near future still seems doubtful.

Plates.—The distributive movement is moderately active, but not much new business is going to the mills, which are offering very little for early delivery. Some new ship contracts have appeared, but the yards are booked too far ahead to permit much more business. Some buying is noted for pipe and tank work. The Western Pipe & Steel Company has taken a large contract for the Anderson-Cottonwood Irrigation District, and will build a lot of tanks at Martinez for the Associated Oil Company. Deliveries on old contracts are very heavy. The jobbing price, San Francisco, remains at 4.75c.

Sheets.—Galvanized sheets still receive little attention, and, with increasing shipments on old orders, immediate needs are fairly well supplied. Current building requirements are limited. A good fall demand is expected, though consumers are not pleased with the prevailing prices. Supplies of blue annealed are still light, though most buyers are covered for the remainder of the year. Routine requirements are fairly large, and the tonnage has been increased by several new manufacturing enterprises.

Wrought Pipe.—Orders going to the mills are lighter than last month, as the jobbing houses, both here and in the oil fields, have put in large stocks which were purchased at lower prices, and new business in lap-weld is curtailed by the inability of mills to deliver. The material in store, however, is moving out in good shape, the plumbing sizes receiving more attention than for some time. The town of Aberdeen, Wash., has taken figures on a lot of 36, 28 and 16 in. lap-weld pipe.

Cast-Iron Pipe.—While municipal business remains rather quiet, buying is a little better than for some weeks. The town of Whittier has contracted for 200 tons, and the Anderson-Cottonwood Irrigation District has taken 118 tons of 36-in. for siphons. Pasadena, Cal., has placed a good sized order, and a small lot has been ordered for Puyallup, Wash. Othello, Wash., is in the market for a lot of 4 and 6 in. A Government inquiry is expected for a line of 4-in. pipe from Key Route pier to Yerba Buena Island.

Pig Iron.—The weakness of primary markets is, of course, reflected in local values, and as a result those who have not already placed contracts covering the remainder of the year are disposed to hold off. There is a limited amount of business for prompt shipment, but current requirements are pretty well met by deliveries on old contracts. No. 1 Southern foundry iron is quoted here at about \$25.50 to \$26 per gross ton.

Coke.—A rather large tonnage is coming in, taking care of all immediate needs, and there is not much contracting for the future, though a few new bookings are reported. The general range on offerings from various sources shows little change, Southern foundry coke being about \$16 per net ton.

Old Material.—While requirements are increasing, the high prices lately offered have brought out a very heavy tonnage, and there is an immense quantity in sight at points off the railroads. Steel makers have already purchased enough to last them for some time, and dealers have rather large accumulations, which, however, are generally firmly held. The top price of steel melting scrap is \$12 per gross ton at present, with less desirable material offered as low as \$8. There is enough call for cast-iron scrap to prevent any great accumulation, prices ranging from \$16 to \$18 per net ton.

Ferroalloys.—Ferrosilicon continues firm. There is a small amount in stock here, and a shipment is expected shortly, but it is impossible to shade the prices that have prevailed for some time. Ferromanganese is much easier, with shipments of foreign material

coming via New Orleans in good shape. A large tonnage of chrome ore is being shipped East from several California points, and some is also being used locally.

The Pacific Coast Steel Company is starting one of its new furnaces this week, and will start the other in about a month. The opening was delayed by tardy delivery of refractory brick from the East. While a very large tonnage of magnesite has been going from California to Eastern steel centers for a year, the manufacture of magnesite brick has not yet been successfully undertaken here, and it is very hard to get deliveries from the East.

Chicago

CHICAGO, ILL., July 5, 1916.—(By Wire.)

The renewal of interest which buyers had begun to evince a week ago has since become more apparent. In the matter of specifications, in particular, a clearly defined broadening of the market is to be noted. There are indications also that a part of the considerable volume of business which has been held in check by high prices is very close to being put upon the market. The resumption of foreign buying on a large scale and the further assurances that have been found regarding the extent to which the larger mills are sold up appear to have restored the interest of many buyers in their future requirements. In some respects the market appears to be on a more sound basis than at any time. Sales of rails in miscellaneous lots last week totaled 35,000 tons and of bars for industrial uses 35,000 tons. Inquiry for steel for 1917 delivery is again more general but, except as contracts are taken for shipment at mill convenience, the mills are not opening their books for first quarter or first half. Irregularities in the prices of sheets continue to manifest themselves, and the volume of business is not sufficient to prevent extreme competitive concessions despite the strengthening influence of the new scale of wages. The domestic market for pig iron is without interest, except for the concern which attaches to the weakness in the South. It is no longer certain that lower than \$14, Birmingham, cannot be done. Inquiry for export iron is broadening out to include foundry grades. In the scrap market the Steel Corporation has again been a buyer of steel scrap, but its purchase of 20,000 tons was dwarfed by comparison with the supply of scrap available for sale.

Pig Iron.—Except for the inquiry from abroad, which has now extended itself to foundry as well as steel-making iron, the pig-iron market is exceedingly quiet, with Southern prices emphatically weak. Such little business as is being placed is being taken by Southern interests. This, however, is almost entirely spot or prompt shipment iron in small quantities. On such business there is reason to believe that \$14, Birmingham, is being done, and with respect to resale iron even lower prices are reported. Inquiry in connection with which the Northern furnaces are able successfully to compete is very limited and scattering. There is some business in charcoal iron. For Lake Superior charcoal iron we quote delivery prices at Chicago to include a freight rate of \$1.75. The following quotations are for iron delivered at consumers' yards, except those for Northern foundry, malleable Bessemer and basic iron, which are f.o.b. furnace, and do not include a switching charge averaging 50c. per ton:

Lake Superior charcoal, Nos. 2 to 5.....	\$19.75
Lake Superior charcoal, No. 1.....	20.25
Lake Superior charcoal, No. 1 and Scotch.....	20.75
Northern coke foundry, No. 1.....	19.50
Northern coke foundry, No. 2.....	19.00
Northern coke foundry, No. 3.....	18.50
Southern coke, No. 1 f'dry and 1 soft.....	19.50
Southern coke, No. 2 f'dry and 2 soft.....	18.50 to 19.00
Malleable Bessemer	19.50
Basic	19.00 to 19.50
Low phosphorus	34.00 to 36.00
Silvery, 8 per cent.....	31.50
Bessemer ferrosilicon, 10 per cent.....	33.50 to 35.50

(By Mail)

Rails and Track Supplies.—Transactions last week in light and heavy section rails for domestic and export shipment totaled nearly 35,000 tons. Of these the largest lot was one of 9000 tons of light rails for portable track in France. Inquiry from Western roads for

track fastenings is limited to requirements of greatest necessity. The railroads now appear to be well covered in that respect for the remainder of the year and for next year interest has largely subsided. The duplication of earlier sales of track fastenings for 1917 at a premium of \$3 per ton would now be decidedly difficult. Quotations are as follows: Standard railroad spikes, 2.75c., base; track bolts with square nuts, 3.25c. to 3.50c., base, all in carload lots, Chicago; tie-plates, \$50, f.o.b. mill, net ton; standard section, Bessemer rails, Chicago, \$33, base; open-hearth, \$35; light rails, 25 to 45 lb., \$40; 16 to 20 lb., \$41; 12 lb., \$42; 8 lb., \$43; angle bars, 2c., Chicago.

Structural Material.—The conditions already outlined as existing for several weeks, with respect to the reselling of structural steel, are still unchanged. Considerable inquiry for plain material in small lots is being satisfied out of fabricators' stocks and from store, but new mill business is light. Mill offerings of Bessemer shapes for prompt shipment still appear. Specifications in general are heavier, even from the carbuilders, whose situation, however, is far from satisfactory. Without an early resumption of car buying, the carbuilding plants seem to have ahead of them an enforced idleness during a considerable period, some plants being even now within sixty days of the end of their orders. Contracts for fabricated steel reported last week include 200 tons for the McKay Building, Chicago, taken by Holmes, Pyott & Co.; 225 tons for the Milford Building, Chicago; 175 tons for a tower tank at Seattle, taken by the Chicago Bridge & Iron Company, and 1530 tons for two factories of the Great Western Sugar Company. The American Bridge Company took a small order for plant extensions for the Great Western Smelting & Refining Company. We quote for Chicago delivery of structural steel from mill 2.689c.

We quote for Chicago delivery of structural steel from jobbers' stock 3.10c.

Plates.—In this district the effect of the large demand for ship plates is reflected rather than direct. Although inquiry covering a heavy tonnage has been received here, there is practically no product available for deliveries such as are required. In small lots Bessemer plates may be had for reasonably prompt shipment, and some orders have been placed for open-hearth stock, but the entire volume of business has been inconsiderable. We quote for Chicago delivery of plates from mill on contract 3.089c. and for prompt shipment 3.689c. to 4.189c.

We quote for Chicago delivery of plates out of jobbers' stocks 3.50c.

Sheets.—The range of prices for black sheets still indicates that under stress of competition various mills are sufficiently eager for business to make concessions which leave them but scant profit on the basis of present sheet-bar prices. Sales are recorded on the basis of 2.80c. to 2.90c., Pittsburgh, and some contracting has been done at as high as 3c. for No. 28 black sheets. On the basis of the new Amalgamated scale, the mill cost of sheets will be increased by about 7 per cent. Some of the mills have indicated their intention to make selling prices take care of this advance, and on the whole the market is somewhat stronger. Blue annealed sheets sold last week in lots of fair size as low as 2.90c. for No. 10, and one contract for 1500 tons was closed on that basis. Galvanized sheets are selling at quotations ranging from 4.50c. to 4.60c., approximately equivalent to a spelter cost of 10c. We quote for Chicago delivery, blue annealed, No. 16 and heavier, 3.089c. to 3.339c.; box annealed, No. 17 and lighter, 2.939c. to 3.039c.; No. 28 galvanized, 4.939c. to 5.039c.

We quote for Chicago delivery of sheets out of stock, minimum prices applying on bundles of 25 or more, as follows: No. 10 blue annealed, 3.40c.; No. 28 black, 3.10c. to 3.20c.; No. 28 galvanized, 5.40c. to 5.50c.

Bars.—New business in steel bars last week was again noteworthy, bookings for domestic delivery and for export for other than ammunition purposes totaling 35,000 tons. Inquiry exceeded business actually placed by a wide margin, owing to the fact that local mills can no longer make definite delivery promises. The

bar-iron mills are still in a very comfortable situation, although new orders are decidedly light. We quote, mill shipment, Chicago, as follows: Bar iron, 2.35c.; soft steel bars, 2.689c. nominal on contracts, 3.18c. for prompt shipment; hard steel bars, 2.50c.; shafting, in carloads, 20 per cent off; less carloads, 15 per cent off.

We quote store prices for Chicago delivery: Soft steel bars, 3.10c.; bar iron, 3.10c.; reinforcing bars, 3.10c. base with 5c. extra for twisting in sizes $\frac{1}{2}$ in. and over and usual card extras for smaller sizes; shafting 10 per cent above list.

Rivets and Bolts.—The market for rivets is attended with unusual indefiniteness as to prices, a situation due in part to the price of 3.50c., at which rivets are obtainable out of stock. Before quoting, manufacturers are seeking to get the exact specifications and quantities in which customers are interested, and quotations are made with some irregularity to meet the particular circumstances. Specifications for bolts and nuts are being maintained in large volume. We quote carriage bolts up to $\frac{1}{2}$ x 6 in., rolled thread, 50-10-5; cut thread, 50-5; larger sizes, 40-5; machine bolts up to $\frac{1}{2}$ x 4 in., rolled thread, with hot pressed square nuts, 50-10-10; cut thread, 50-10; larger sizes, 40-10-5; gimlet point coach screws, 60; hot pressed nuts, square, \$2.90 off per 100 lb.; hexagon, \$2.90 off. Structural rivets, $\frac{1}{4}$ to $1\frac{1}{4}$ in., 4c. to 4.15c., base, Chicago, in carload lots; boiler rivets, 10c. additional.

We quote out of store: Structural rivets, 3.50c.; boiler rivets, 3.60c.; machine bolts up to $\frac{1}{2}$ x 4 in., 60-10; larger sizes, 50-10; carriage bolts up to $\frac{1}{2}$ x 6 in., 60-5; larger sizes, 50 off; hot pressed nuts, square, \$3.25, and hexagon, \$3.25 off per 100 lb.; lag screws, 65.

Old Material.—The actual situation in the scrap market appears to have been disclosed last week through the purchase of about 20,000 tons of steel scrap for the Illinois Steel Company and an additional quantity for associated interests at Pittsburgh. The opinion has largely prevailed that prices for scrap were simply nominal in the absence of demand, but that the appearance of any order of consequence would immediately result in a sharp recovery of strength. Developments have indicated an unexpected eagerness to sell, and the above orders were readily placed on the basis of \$14.50 and with every appearance that the market would have absorbed a larger tonnage without further advance in price. Except for the fact that the sale price establishes the market for the few grades of scrap directly affected, other prices remain weak and buying in general continues at very low ebb. Railroad offerings for the week include 4000 tons from the Chicago & Northwestern, 2700 tons from the Santa Fe and lists from New York Central and Pennsylvania lines. We quote for delivery at buyers' works, Chicago and vicinity, all freight and transfer charges paid, as follows:

<i>Per Gross Ton</i>	
Old iron rails	\$18.00 to \$18.50
Relaying rails	19.50 to 20.50
Old carwheels	12.00 to 12.25
Old steel rails, rerolling	15.00 to 15.50
Old steel rails, less than 3 ft.	15.00 to 15.25
Heavy melting steel scrap	14.25 to 14.50
Frogs, switching and guards, cut apart	14.25 to 14.50
Shoveling steel	13.50 to 14.00
Steel axle turnings	9.25 to 9.75

<i>Per Net Ton</i>	
Iron angles and splice bars	\$18.25 to \$18.75
Iron arch bars and transoms	19.50 to 20.00
Steel angle bars	18.50 to 14.00
Iron car axles	22.50 to 23.00
Steel car axles	22.75 to 23.25
No. 1 railroad wrought	14.50 to 15.00
No. 2 railroad wrought	13.75 to 14.00
Cut forge	13.75 to 14.00
Pipes and flues	10.50 to 10.75
No. 1 busheling	12.00 to 12.50
No. 2 busheling	8.00 to 8.50
Steel knuckles and couplers	13.50 to 14.00
Steel springs	14.00 to 14.50
No. 1 boilers, cut to sheets and rings	9.25 to 9.75
Boiler punchings	12.50 to 14.00
Locomotive tires, smooth	20.00 to 20.50
Machine shop turnings	5.25 to 5.75
Cast borings	5.25 to 5.75
No. 1 cast scrap	11.50 to 12.00
Stove plate and light cast scrap	9.25 to 9.75
Grate bars	10.00 to 10.25
Brake shoes	9.75 to 10.25
Railroad malleable	11.75 to 12.25
Agricultural malleable	10.75 to 11.25

Cast-Iron Pipe.—The awards of 1000 tons of pipe at Milwaukee and 450 tons at Waukegan, Ill., have not yet been made, although in the former instance the busi-

ness is expected to go to the leading interest. A few small lots comprise all the additional business in sight. We quote as follows, per net ton, Chicago: Water pipe, 4 in., \$33.50 to \$34; 6 in. and larger, \$30.50 to \$31, with \$1 extra for class A water pipe and gas pipe.

Wire Products.—In the last week some improvement is noted in the volume of both specifications and contracts for the common forms of wire, an improvement attributable in many instances to the replacement of stocks at distributing points. Renewal of inquiry from abroad on a large scale has likewise had a strengthening influence. Prices are without change. We quote as follows: Plain wire, Nos. 6 to 9, base, \$2.639; wire nails, \$2.689; painted barb wire, \$2.839; galvanized barb wire, \$3.539; polished staples, \$2.839; galvanized staples, \$3.539, all Chicago.

New York

NEW YORK, July 5, 1916.

Pig Iron.—Export inquiry is still of much more importance than anything for home consumption. A New England maker of machine tools has bought from 600 to 700 tons of foundry iron for delivery this year, and some resale iron has figured in scattered foundry buying for this district. Apparently Virginia resale iron has now been pretty well taken up, but the softening effect of Southern resales is apparent in the general foundry-iron market. One local pig-iron firm has sold 7500 tons of Bessemer iron for shipment to Italy, and another has sold several thousand tons of steel-making iron for export in the past week. There is inquiry from Holland for a number of lots of foundry iron amounting to several thousand tons. One item in the very large amount of Italian business that is in the market is 10,000 tons of charcoal iron, but the requirements in phosphorus are below anything American makers are prepared to entertain. Whether low phosphorus coke iron will be taken eventually instead does not appear. One inquiry for Bessemer iron for export is for 10,000 tons running 0.08 in phosphorus and 1 to 2 per cent in silicon. There is also some inquiry for pig iron from South America. We quote at tidewater for early delivery: No. 1 foundry, \$20.50 to \$21; No. 2X, \$19.75 to \$20.25; No. 2 plain, \$19.50 to \$20; Southern iron at tidewater, \$20 to \$20.50 for No. 1 and \$19.50 to \$20 for No. 2 foundry and No. 2 soft.

Ferroalloys.—Ferromanganese for early delivery is weaker and it is understood that a small lot has been sold at \$175, seaboard. The quotation a week ago was \$225 to \$250. Further quantities are reported to have been offered at \$175 for spot shipment, but the demand is so weak that the market has not really been tested. Consumers are evidently well covered for some time and domestic offerings are increasing. Foreign inquiries for about 1000 tons have also appeared, but they are not reported to have resulted in any sales. Spiegel-eisen is quiet at \$50 to \$55, furnace, on contract. Ferrosilicon, 50 per cent, is very strong and selling at \$90 to \$100 for early delivery.

Finished Iron and Steel.—Export buying is easily of chief interest in a week otherwise dull. Settlement of the Russian purchases of rails, barb wire and railroad cars is imminent, while inquiries under fresh consideration include 5000 tons of plates for Japan, 4000 tons for Italy, 1500 tons of soft Bessemer good size rounds for export, a round tonnage of 84 and 155 millimeter bars for France or Italy, and offerings for different forms of steel from non-belligerent nations, with Argentine among others asking for wire. Bessemer steel is not so freely offered, a quotation on billets being \$51 and one on rounds about 3 in. in diameter being 3½c. per pound. The situation in structural steel is that fabricators with over two months' work ahead (and few have over three months to the windward) cannot take much of the smaller jobs in project, owing to the delivery time exactation, and fabrication and erection work is thus being well distributed. As regards the plain material, deliveries are somewhat better and the price range is narrow between prompt and future shipments. Universal plates have sold for 3½c. for four weeks delivery, but sheared

plates are strong at 4c. The higher premiums for steel bars are not so easily obtained. We quote mill shipments of plain structural material at 2.669c. to 2.919c., New York; steel plates at 2.919c. to 4.169c., New York, according to the time of delivery, with universal plates at 3.669c. to 3.919c.; steel bars at 2.669c. to 2.919c., and iron bars at 2.669c. New York. Out of warehouse, we quote iron and steel bars and structural material at 3.10c. to 3.30c., New York, and plates at 4c. to 4.25c.

Cast-Iron Pipe.—Jersey City, N. J., will open bids July 11 on about 300 tons of 4, 6, 8 and 12 in. Private buying continues in about the same volume. Prices are unchanged. Carload lots of 6-in., class B and heavier, are quoted at \$30.50 per net ton, tidewater, class A and gas pipe taking an extra of \$1 per ton.

Old Material.—A few transactions are reported, principally in steel scrap and rolling-mill stock, but the general situation continues quiet. Brokers quote buying prices about as follows to local dealers and producers, per gross ton, New York:

Heavy melting steel scrap (eastern Pennsylvania specifications)	\$11.75 to \$12.25
Old steel rails (short lengths) or equivalent	12.75 to 13.25
Relaying rails	28.00 to 30.00
Rerolling rails	15.50 to 16.00
Iron car axles	26.00 to 27.00
Steel car axles (for domestic use)	28.50 to 29.00
Steel car axles (for export)	30.00 to 31.00
No. 1 railroad wrought	18.00 to 18.50
Wrought-iron track scrap	15.00 to 15.50
No. 1 yard wrought, long	14.50 to 15.00
No. 1 yard wrought, short	11.75 to 12.25
Light iron (nominal)	5.00
Cast borings (clean)	8.00 to 8.25
Machine shop turnings (nominal)	6.25 to 6.50
Mixed borings and turnings	6.50 to 6.75
Wrought pipe	10.00 to 10.50
Old carwheels (nominal)	15.00 to 15.50
Malleable cast (railroad)	12.25 to 12.75

The disposition of molders to demand higher wages and shorter hours, together with the slack demand for castings for machine shops, is causing foundries to withhold buying orders, and the week has therefore been extremely dull. Dealers' quotations to consumers of cast scrap are as follows, per gross ton, New York:

No. 1 cast (machinery)	\$16.00
No. 2 cast (heavy)	15.00
Stove plate	12.00
Locomotive grate bars	12.00

British Steel Market

Pig-Iron Selling Freely—Little Demand for American Billets

(By Cable)

LONDON, ENGLAND, July 5, 1916.

Pig-iron makers are booking freely until December. Export trade is small with licensing difficulties paramount. American billets are dull. Tin plates are unsettled and irregular at 33s. to 35s.

Benzol is quoted at 11½d., toluol at 2s. 3d., solvent naphtha at 2s. 2d. and ammonium sulphate at £15 17s. 6d. Quotations, mostly nominal, are as follows:

Tin plates, coke, 14 x 20, 112 sheets, 108 lb., f.o.b. Wales, 33s. to 35s., against 35s. a week ago.
Steel black sheets, No. 28, export, f.o.b. Liverpool, £20 5s.
Steel ship plates, Scotch, delivered local yards, £13 17s. 6d.
Steel rails, export, f.o.b. works port, £10 17s. 6d.
Hematite pig iron, f.o.b. Tees, about 140s.
Sheet bars (Welsh) delivered at works in Swansea Valley, £14 5s.
Steel bars, export, f.o.b. Clyde, £18 5s.
Ferromanganese, £35 nominal.
Ferrosilicon, 50 per cent, c.i.f., £29.

Scarcity of Semi-Finished Steel—A New Manganese Ore Deposit in Africa

(By Mail)

LONDON, ENGLAND, June 20, 1916.—Although every effort is being made in the British industry to force production to the utmost capacity, the scarcity of both crude iron and finished material is as intense as ever. Exports are severely restricted, although the returns for May showed a very large increase, largely due to

the abnormally heavy quantities sent to the Allies in order to keep pace with their most urgent needs. A good deal of iron will probably yet be sent to France, but now licenses for new export business are very hard to get. The distribution of supplies in the home trade has given more satisfaction to consumers lately, but the deliveries are rigidly controlled, while it is understood that the control committee on the East Coast decided to suspend shipments of Cleveland to Scotland till the stocks of Scotch iron are exhausted.

Owing to the increased cost of production the tendency of pig iron is still upward, makers in various districts urging an increase in the maximum price for delivery after July 1, for which an advance to 87s. 6d. was already announced in the case of Cleveland iron. It is hoped, however, that with the increase looked for in the output more iron will become available shortly, both for home consumers and the Allies. Export terms for Cleveland and hematite have remained quite nominal, the latter being almost unobtainable. The tendency of Spanish ore has been harder again.

Steel producers find increasing difficulty in covering their needs, and there is no relief in sight from the dearth of semi-finished steel, which has compelled France of late to have resort to additional supplies from American and Canadian producers at high costs. The rolling mills are very short of steel. There is a famine in Welsh sheet bars, the cost of which to local consumers has risen to well over £14 a ton.

The tin-plate mills are severely handicapped by the scarcity of steel and labor. There has been some reaction in prices from the highest figures recorded, owing to sales by second hand, which has checked the demand, but this is merely temporary.

The various finishing grades are now almost entirely under government control, but requirements are getting further ahead of the supply available, war orders taking up the great bulk of the material, so that mercantile users find it hard to get supplies. About 10,000 steel smelters in Sheffield will benefit by an award given by the Board of Trade arbitrator, which gives workmen earning up to 40s. a week an advance in wages of 7½ per cent and workmen earning 40s. to 60s. a week, 5 per cent, this in addition to the war bonus of 8d. to 10d. a day which the men were already receiving.

The export demand for ferromanganese has been somewhat quiet, but the tone remains firm at prices ranging upward of £35 basis, f.o.b., for loose, according to shipment. It is now very hard to place orders for this year's shipments, for producers are already heavily booked. There is a little more doing in Indian manganese ore since freight room is somewhat more plentiful.

Manganese ore deposits have been found on the property of the Fanti Consolidated Mines (West Africa), which are to be exploited, and shipments are likely to be made soon.

German Steel Output for April

The German steel output for April was 1,202,598 metric tons or 52,286 tons per day, which contrasts with an output of 1,347,795 tons in March at 49,918 tons per day, the war record. The production in February also exceeded the April output, but the April daily rate for the 23 working days was the largest for the war. The April production was made up of 606,662 tons of Bessemer steel, 508,447 tons of open-hearth steel, 67,457 tons of steel castings, 7977 tons of crucible steel and 12,055 tons of electric steel. The steel output to May 1, 1916, was 5,015,158 tons, as against 4,047,886 tons to May 1, 1915. The electric steel output still maintains its high rate.

At South Bethlehem, Pa., last week an important conference of operating managers and safety engineers of the subsidiary companies of the Bethlehem Steel Corporation was held, which occupied several days. Standardizing of safety and welfare methods were discussed, as well as other matters pertaining to safety and welfare work.

Iron and Industrial Stocks

NEW YORK, July 5, 1916.

The stock market has been subjected to varying influences. For a few days conditions were regarded as favorable and a slight upward movement took place, but this was followed by a decline, due to disappointment over the showing made in the annual report of the American Car & Foundry Company, together with the proposal by the Ways and Means Committee of the House of Representatives to put a heavy tax on the production of munitions. The range of prices on active iron and industrial stocks from Wednesday of last week to Monday of this week was as follows:

Allis-Chal., com.	23 1/2 - 25	Ry. Stl. Spring, com.	40 1/2 - 43 1/2
Allis-Chal., pref.	75 1/2 - 79 1/2	Ry. Stl. Spring, pref.	96 1/2
Am. Can., com.	51 - 53 1/2	Republic, com.	43 1/2 - 46
Am. Can., pref.	109 1/2	Republic, pref.	107 - 107 1/2
Am. Car & Fdy., com.	53 1/2 - 56 1/2	Sloss, com.	47 - 48
Am. Car & Fdy., pref.	116 1/2 - 117	Pipe, com.	20 - 21 1/2
Am. Loco., com.	65 1/2 - 69	U. S. Steel, com.	83 1/2 - 86 1/2
Am. Loco., pref.	101 1/2 - 102	U. S. Steel, pref.	117 1/2 - 117 1/2
Am. Steel Fdries.	47 1/2 - 49 1/2	Va. I. C. & Coke.	49
Bald. Loco., com.	69 1/2 - 80	Westing. Elec.	55 1/2 - 59 1/2
Bald. Loco., pref.	104 1/2 - 105 1/2	Am. Rad., com.	395 - 399
Beth. Steel, com.	437 - 442	Am. Ship, com.	43 - 44
Case (J. L.), pref.	88 1/2	Am. Ship, pref.	90 1/2 - 90 1/2
Colorado Fuel.	41 - 42 1/2	Chic. Pneu. Tool.	68 - 70 1/2
Deere & Co., pref.	90 1/2	Lake Sup. Corp.	10 1/2 - 10 1/2
Gen. Electric.	163 - 168	Warwick	9 1/2
Gt. No. Ore Cert.	33 1/2 - 35 1/2	Cruc. Steel, com.	69 1/2 - 78 1/2
Int. Harv. of N. J., com.	113 1/2	Cruc. Steel, pref.	114 1/2 - 115 1/2
Int. Harv. Corp., com.	78	Harb.-Walk. Refrac.	92 1/2
Lacka. Steel	66 1/2 - 67 1/2	Harb.-Walk. Refrac., pref.	102 1/2 - 103
Nat. En. & Stm., com.	23 1/2 - 24 1/2	La Belle Iron, com.	50 1/2 - 53
N. Y. Air Brake.	130 - 135	Carbon Steel, com.	75
Pitts. Steel, pref.	96	Driggs-Seabury	127 - 131
Pressed Stl., com.	45 1/2 - 47 1/2	Midvale Steel.	62 1/2 - 64 1/2

Dividends

The E. W. Bliss Company, extra, 100 per cent on the common stock, payable July 14. In the first six months of 1916 the company has declared a total of 125 per cent, or \$62.50 a share on the common stock. In 1915 dividends on the common amounted to 20 per cent, or \$10 a share. The present 100 per cent is to be paid out of accumulated earnings.

The Pittsburgh Coal Company, regular quarterly, 1 1/4 per cent on the preferred stock, payable July 25.

The Steel Company of Canada, regular quarterly, 1 1/4 per cent on the preferred stock.

The Colorado Fuel & Iron Company, 30 per cent on the preferred stock, payable Aug. 15. The amount still due on account of accumulated dividends will then be 29 per cent.

The Tungsten-Molybdenum System

The tungsten molybdenum system is discussed by Dr. Frank A. Fahrenwald of Cleveland, Ohio, in a paper to be presented at the Arizona meeting of the American Institute of Mining Engineers in September. The results of an investigation of alloys of these two elements, in which methods were employed that avoided the usual difficulties accompanying high-temperature alloy investigations, are summarized as follows:

1. By compressing the mixed reduced powders of tungsten and molybdenum into briquettes and then heating with an electric current in an atmosphere of hydrogen, alloys of this series were prepared varying in composition from 100 per cent tungsten to 100 per cent molybdenum.

2. The solidus curve for the series was located by means of optical pyrometer temperature measurements and checked by comparing the fusing current with a standardized wattage-temperature curve.

3. The equilibrium diagram for this series shows no critical points, appearing as resistance fluctuations, corresponding to a separation of a new phase. Its construction has been based upon this fact and upon results of microscopical analysis.

4. Curves for hardness and for equiaxed temperatures are smoothly convex, being typical of an uninterrupted series of solid solutions (mixed crystals).

5. As a result of thermal and microscopical analysis, the metals tungsten and molybdenum are reported to be completely isomorphous.

6. All alloys of this series are malleable and ductile under proper conditions.

The American demand for Japanese zinc dust has expanded greatly since the war. About 600 tons is sent yearly to New York and San Francisco importers from the Nagasaki district.

Finished Iron and Steel f.o.b. Pittsburgh

Freight rates from Pittsburgh in carloads, effective from April 10, 1916, per 100 lb.: New York, 16.9c.; Philadelphia, 15.9c.; Boston, 18.9c.; Buffalo, 11.6c.; Cleveland, 10.5c.; Cincinnati, 15.8c.; Indianapolis, 17.9c.; Chicago, 18.9c.; St. Louis, 23.6c.; Kansas City, 43.6c.; Omaha, 43.6c.; St. Paul, 32.9c.; Denver, 68.6c.; New Orleans, 30.7c.; Birmingham, Ala., 45c.; Pacific coast (by rail only), 65c.

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in. on one or both legs, $\frac{1}{4}$ in. thick and over, and zees 3 in. and over, 2.50c. to 2.75c. Extras on other shapes and sizes are as follows:

	Cents per lb.
I-beams over 15 in.	.10
H-beams over 18 in.	.10
Angles over 6 in., on one or both legs	.10
Angles, 3 in. on one or both legs less than $\frac{1}{4}$ in. thick, as per steel bar card, Sept. 1, 1909	.70
Tees, structural sizes (except elevator, handrail, car truck and conductor rail)	.05
Channels and tees, under 3 in. wide, as per steel bar card, Sept. 1, 1909	.20 to .80
Deck beams and bulb angles	.30
Handrail tees	.75
Cutting to lengths, under 3 ft. to 2 ft. inclusive	.25
Cutting to lengths, under 2 ft. to 1 ft. inclusive	.50
Cutting to lengths, under 1 ft.	.155
No charge for cutting to lengths 3 ft. and over	

Plates.—Tank plates, $\frac{1}{4}$ in. thick, 6 in. up to 100 in. wide, 2.90c. to 4c., base, net cash, 30 days, or $\frac{1}{2}$ of 1 per cent discount in 10 days, carload lots. Extras are:

Quality Extras	Cents per lb.
Tank steel	Base
Pressing steel (not flange steel for boilers)	.10
Boiler and flange steel plates	.15
"A. B. M." and ordinary firebox steel plates	.20
Still bottom steel	.30
Locomotive firebox steel	.50
Marine steel, special extras and prices on application	

Gage Extras	
Rectangular, $\frac{1}{4}$ in. thick, over 6 in. wide to 100 in. wide.. Base	
Lighter than $\frac{1}{4}$ in., to $\frac{3}{16}$ in., up to 72 in. wide	.10
*Lighter than $\frac{1}{4}$ in., including $\frac{3}{16}$ in., over 72 in. to 84	.20
*Lighter than $\frac{1}{4}$ in., including $\frac{3}{16}$ in., over 84 in. to 96	.30
*Lighter than $\frac{1}{4}$ in., including $\frac{3}{16}$ in., over 96 in. to 100	.40
*Lighter than $\frac{1}{4}$ in., including $\frac{3}{16}$ in., over 100 in. to 102	.45
Lighter than $\frac{1}{4}$ in., including No. 8, up to 72 in. wide	.15
*Lighter than $\frac{1}{4}$ in., including No. 8, over 72 in. to 84	.25
*Lighter than $\frac{1}{4}$ in., including No. 8, over 84 in. to 96	.35
Lighter than No. 8, including No. 10, up to 60 in. wide	.30
Lighter than No. 8, including No. 10, over 60 in. to 64..	.35
Up to 72 in., not less than 10.2 lb. per sq. ft. will be considered $\frac{1}{4}$ in.	
Over 72 in. must be ordered $\frac{1}{4}$ in. thick on edge, or not less than 11 lb. per sq. ft. to take base price.	
Over 72 in. wide, ordered less than 11 lb. per sq. ft., down to weight of $\frac{3}{16}$ in., take price of $\frac{3}{16}$ in.	
Over 72 in., ordered weight $\frac{3}{16}$ in., take No. 8 price.	
Over 72 in., ordered weight No. 8, take No. 10 price.	

Width Extras	
Over 100 in. to 110 in. inclusive	.65
Over 110 in. to 115 in. inclusive	.10
Over 115 in. to 120 in. inclusive	.15
Over 120 in. to 125 in. inclusive	.25
Over 125 in. to 130 in. inclusive	.50
Over 130 in.	1.00

Length Extras	
Universal plates 80 ft. long up to 90 ft. long	.05
Universal plates 90 ft. long up to 100 ft. long	.10
Universal plates 100 ft. long up to 110 ft. long	.20

Cutting Extras	
No charge for rectangular plates to lengths 3 ft. and over.	
Lengths under 3 ft. to 2 ft. inclusive	.25
Lengths under 2 ft. to 1 ft. inclusive	.50
Lengths under 1 ft.	1.55
Circles 3 ft. in diameter to 100 in.	.30
Circles over 100 to 110 in. (width extra)	.35
Circles over 110 to 115 in. (width extra)	.40
Circles over 115 to 120 in. (width extra)	.45
Circles over 120 to 125 in. (width extra)	.55
Circles over 125 to 130 in. (width extra)	.80
Circles over 130 in. (width extra)	1.30
Circles under 3 ft. to 2 ft. inclusive	.55
Circles under 2 ft. to 1 ft. inclusive	.80
Circles under 1 ft.	1.85
Half circles take circle extras.	
Sketches, not over four straight cuts, inc. straight taper	.10
Sketches having more than four straight cuts	.20
Plates sheared to a radius take complete circle extras.	

*Including extra for width.

Wire Rods.—Including chain rods, \$50 to \$55.

Wire Products.—Prices to jobbers, effective May 1: Fence wire, Nos. 6 to 9, per 100 lb., terms 60 days or 2 per cent discount in 10 days, carload lots, annealed, \$2.45; galvanized, \$3.15. Galvanized barb wire and staples, \$3.35; painted, \$2.65. Wire nails, \$2.50 to \$2.60. Galvanized nails, 1 in. and longer, \$2 advance over base price; shorter than 1 in., \$2.50 advance over base price. Cement-coated nails, \$2.50. Woven wire fencing, 61 $\frac{1}{2}$

per cent off list for carloads, 60 $\frac{1}{2}$ off for 1000-rod lots, 59 $\frac{1}{2}$ off for less than 1000-rod lots.

The following table gives the price per 100 lb. to retail merchants on fence wire in less than carloads, with the extras added to the base price:

Nos.	6 to 9	10	11	12 & 12 $\frac{1}{2}$	13	14	15	16
Annealed	\$2.50	\$2.55	\$2.60	\$2.65	\$2.75	\$2.85	\$2.95	\$3.05
Galvanized	3.20	3.25	3.30	3.35	3.45	3.55	4.00	4.10

Wrought Pipe.—The following are the jobbers' carload discounts on the Pittsburgh basing card in effect from April 21, 1916, all full weight pipe:

Butt Weld			Iron		
Steel	Black	Galv.	Steel	Black	Galv.
$\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$...	63	30 $\frac{1}{2}$	$\frac{1}{4}$ and $\frac{1}{2}$...	52	19
$\frac{1}{2}$...	67	46 $\frac{1}{2}$	$\frac{1}{2}$...	53	20
$\frac{3}{4}$ to 3 ...	70	50 $\frac{1}{2}$	$\frac{1}{2}$...	57	33
			$\frac{1}{2}$ to 1 $\frac{1}{2}$...	60	38

Lap Weld		
2 ...	65	45 $\frac{1}{2}$
2 $\frac{1}{2}$ to 6 ...	68	48 $\frac{1}{2}$
7 to 12 ...	65	44 $\frac{1}{2}$
13 and 14 ...	53 $\frac{1}{2}$	2 $\frac{1}{2}$ to 4 ...
15 ...	51	4 $\frac{1}{2}$ to 6 ...
		7 to 12 ...

Reamed and Drifted		
1 to 3, butt ...	68	48 $\frac{1}{2}$
2, lap ...	63	43 $\frac{1}{2}$
2 $\frac{1}{2}$ to 6, lap ...	66	46 $\frac{1}{2}$
		2 $\frac{1}{2}$ to 4, lap ...

Butt Weld, extra strong, plain ends		
$\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$...	59	35 $\frac{1}{2}$
$\frac{1}{2}$...	64	45 $\frac{1}{2}$
$\frac{3}{4}$ to 1 $\frac{1}{2}$...	68	49 $\frac{1}{2}$
2 to 3 ...	69	50 $\frac{1}{2}$

Lap Weld, extra strong, plain ends		
2 ...	63	44 $\frac{1}{2}$
2 $\frac{1}{2}$ to 4 ...	66	47 $\frac{1}{2}$
4 $\frac{1}{2}$ to 6 ...	65	46 $\frac{1}{2}$
7 to 8 ...	61	40 $\frac{1}{2}$
9 to 12 ...	56	35 $\frac{1}{2}$

Butt Weld, double extra strong, plain ends		
$\frac{1}{2}$...	55	38 $\frac{1}{2}$
$\frac{3}{4}$ to 1 $\frac{1}{2}$...	58	41 $\frac{1}{2}$
2 to 2 $\frac{1}{2}$...	60	43 $\frac{1}{2}$

Lap Weld, double extra strong, plain ends		
2 ...	55	38 $\frac{1}{2}$
2 $\frac{1}{2}$ to 4 ...	57	40 $\frac{1}{2}$
4 $\frac{1}{2}$ to 6 ...	56	39 $\frac{1}{2}$
7 to 8 ...	51	30 $\frac{1}{2}$

To the large jobbing trade an additional 5 per cent is allowed over the above discounts.

The above discounts are subject to the usual variation in weight of 5 per cent. Prices for less than carloads are two (2) points lower basing (higher price) than the above discounts on black and three (3) points on galvanized.

Sheets.—Makers' prices for mill shipments on sheets, of U. S. standard gage, in carload and larger lots, are as follows, 30 days net, or 2 per cent discount in 10 days:

Blue Annealed Sheets	Cents per lb.
Nos. 3 to 8 ...	2.95 to 3.20
Nos. 9 to 10 ...	3.00 to 3.25
Nos. 11 and 12 ...	3.05 to 3.30
Nos. 13 and 14 ...	3.10 to 3.35
Nos. 15 and 16 ...	3.20 to 3.45

Box Annealed Sheets, Cold Rolled	
Nos. 17 to 21 ...	2.70 to 2.80
Nos. 22 and 24 ...	2.75 to 2.85
Nos. 25 and 26 ...	2.80 to 2.90
No. 27 ...	2.85 to 2.95
No. 28 ...	2.90 to 3.00
No. 29 ...	2.95 to 3.05
No. 30 ...	3.15 to 3.25

Galvanized Sheets of Black Sheet Gage	
Nos. 10 and 11 ...	3.50 to 3.60
No. 12 ...	3.60 to 3.70
Nos. 13 and 14 ...	3.60 to 3.70
Nos. 15 and 16 ...	3.70 to 3.80
Nos. 17 to 21 ...	3.85 to 3.95
Nos. 22 and 24 ...	3.95 to 4.05
Nos. 25 and 26 ...	4.10 to 4.20
No. 27 ...	4.35 to 4.45
No. 28 ...	4.50 to 4.60
No. 29 ...	4.65 to 4.75

Boiler Tubes.—Discounts on less than carloads, freight to destination added, effective from April 15, 1916, are as follows:

Lap Welded Steel

Metal Markets

The Week's Prices

Cents Per Pound for Early Delivery

		Copper, New York	Tin,	Lead	Spelter		
June	Lake	Electro- lytic	New York	New York	St. Louis	New York	St. Louis
28.	27.25	26.50	39.00	6.85	6.65	11.62½	11.37½
29.	27.25	26.50	39.37½	6.85	6.65	11.50	11.25
30.	27.25	26.50	39.62½	6.85	6.65	11.25	11.00
July	1.	27.00	26.50	....	6.85	6.65	11.25
	3.	27.00	26.50	38.87½	6.85	6.65	11.00
	4.	....	....	....	....	....	10.75

NEW YORK, July 5, 1916.

Copper continues dull, with prices nominal. Tin is quiet and lower. Lead is in light demand and irregular. The downward trend in spelter continues, but consumers are not interested. Antimony is inactive and lower. The holiday contributed to the quiet of the entire market.

New York

Copper.—The market has been so dull that it is difficult to see how it could be more so, and naturally there are few features of interest to report. One, however, is that near-by copper is not so plentiful as it was, despite all reports. Prices continue to be supported by the sold-up condition of the producers. There is a growing feeling that the great drive of the Allies now under way may create a fresh demand, inasmuch as enormous quantities of ammunition are being destroyed. The exports in June reached the excellent total of 35,753 tons. This, with one exception, was the largest for any month since the war started. Electrolytic is nominal at 26.50c., New York, for prompt delivery, and Lake is nominal at 27c.

Copper Averages.—The average price of Lake copper for the month of June, based on daily quotations in THE IRON AGE, was 27.82c., and of electrolytic, 27.31c.

Tin.—Throughout the week, on the few days when business was done, the market has been dull and weak. Straits tin was quoted on Monday at 38.87½c., but the low price did not tempt buyers. The supply is large. The arrivals in June totaled 5695 tons. Deliveries totaled 6398 tons, indicating that consumption is heavy. Of the total deliveries, 2198 tons came from the Pacific coast, a considerable part of which was Chinese tin. In view of the large deliveries, a dull market is predicted for July. In stock and landing, June 30, was 3963 tons, against 2468 tons on May 31, an increase of 1495 tons. The total of American deliveries in the past six months was 28,621 tons, which compares with 22,217 tons in the first half of 1915, an increase of 6404 tons. The London market continues weak.

Lead.—Views of the market are mixed, and indicate irregularity. Some interests say the market is very dull, while others report a fair demand. It is reported that substantial concessions have been made for shipments over the remainder of the year. The New York quotation of independent sellers Monday was 6.85c., and that at St. Louis, 6.65c., with the leading interest continuing to quote 7c., New York, and 6.92½c., St. Louis. The June exports total 2029 tons. The London market is weak.

Spelter.—This metal is the most inactive of any, and the steadily declining prices while closely watched by consumers have not stirred them into buying. Prompt can be had easily at 11c., New York, and 10.75c., St. Louis. July delivery is obtainable at 10.50c., St. Louis, and August at 10c. The London market is keeping pace with that of New York in the downward trend. The exports in June total 4275 tons.

Antimony.—The dullness and weakness which have characterized this metal in the past few weeks are as acute as ever. The quotation for spot is 16c., but it is believed that a firm offer at considerably less would be accepted. July delivery can be had at 15c. It is not believed that the price will stiffen to any considerable degree unless there is a revival of shrapnel shell orders in this country, and this is regarded as very doubtful.

Aluminum.—The quotation for No. 1 virgin aluminum, 98 to 99 per cent pure, is easier at 60c. to 62c.

Old Metals.—The market is very unsettled. Dealers' selling prices are as follows:

	Cents per lb.
Copper, heavy and crucible	23.50 to 24.50
Copper, heavy and wire	23.00 to 24.00
Copper, light and bottoms	18.50 to 19.50
Brass, heavy	13.50 to 14.00
Brass, light	11.00 to 11.50
Heavy machine compositions	17.75 to 18.25
No. 1 yellow rod brass turnings	13.50 to 14.50
No. 1 red brass or composition turnings	14.50 to 15.50
Lead, heavy	6.00
Lead, tea	5.50
Zinc	8.00 to 9.00

Chicago

JULY 3.—Notwithstanding fair activity in copper, prices continue heavy, and the unusual spread between casting and Lake persists. Spelter suffered another sharp decline, spot prices going to 10.50c. in some instances, while third quarter contracts are even lower. Prices generally are lower. We quote: Casting copper, 24.50c.; Lake copper, 27c.; tin, carloads, 40c., and small lots, 42c.; lead, 6.70c. to 6.80c.; spelter, 10.75c.; sheet zinc, 18c.; Cookson's antimony, 50c.; other grades, 19c. On old metals we quote buying prices for less than carload lots as follows: Copper wire, crucible shapes, 18.25c.; copper bottoms, 16c.; copper clips, 17c.; red brass, 15.50c.; yellow brass, 11.50c.; lead pipe, 4.75c.; zinc, 5.25c.; pewter, No. 1, 20c.; tinfoil, 24c.; block tin pipe, 29c.

St. Louis

JULY 3.—Market conditions have been quiet, with a tendency to ease off. Quotations at the close to-day were as follows: Lead, held at 6.75c., with 6.65c. bid; spelter, nominally 11.25c. to 11.50c. for prompt shipment and 11c. for all July shipment; tin, 39.35c.; Lake copper, 28c. to 28.25c.; electrolytic copper, 26.75c. to 27c.; antimony, Asiatic, 18c. In the Joplin district there was a further decline in prices, with the top figure for 60 per cent zinc ore \$85 per ton, with premium settlements as high as \$87.50, and the range was down to \$60, second grade, with the average for the week \$68. Calamine sold at \$45 to \$60, with the average for the week \$50. Lead ore was unchanged at \$77.50, basis of 80 per cent metal, with the district average at \$75. On miscellaneous scrap metals we quote dealers' buying prices as follows: Light brass, 8.50c.; heavy yellow brass, 11.50c.; heavy red brass and light copper, 15c.; heavy copper and copper wire, 18c.; pewter, 25c.; tinfoil, 32c.; zinc, 7.50c.; lead, 5c.; tea lead, 4c.

May Iron and Steel Exports a Record

WASHINGTON, D. C., July 5, 1916.—(By Telephone.)—The value of exports of iron and steel commodities of all kinds for the month of May, 1916, was \$72,918,913, as compared with \$58,722,411 for the month of April. This exceeds the best previous monthly record by 24 per cent. For the 11 months ended May, 1916, the total value was \$545,418,532, as compared with \$194,131,255 in the same period in 1915, and \$279,377,451 in 1913, the movement for the eleven months thus surpassing the record by nearly 100 per cent.

W. L. C.

Steel merchant vessel building or under contract in private American shipyards on June 1, 1916, numbered 372 of 1,147,534 gross tons, comparing with 368 of 1,129,014 gross tons on May 1. Twenty new contracts were closed in May representing a tonnage of 81,470, and 13 vessels completed having a tonnage of 53,840.

The Harrisburg Pipe & Pipe Bending Company, Harrisburg, Pa., which recently completed two orders for 700,000 shrapnel shells for the British Government, has received an order for 22,000 3-in. shells for use in the United States Ordnance Department.

REVIEW OF THE TIN SITUATION*

A Preliminary to the Drafting of a Specification
by the A. S. T. M.

BY L. ADDICKS AND W. A. COWAN

A specification to be generally adopted must reasonably reconcile the inherent different points of view of producer and consumer. This requires a classification of the material which will allow the producer to market everything produced and the consumer to choose the grade suitable for his particular work, paying accordingly. It is obviously necessary to understand the situation from both sides when a specification is to be drawn up, and this providing of a common ground is one of the chief functions of this society.

In the case of tin this mutual understanding is wholly lacking at the present time, due chiefly to the great geographical distance between the points of production and consumption and the speculative basis on which tin is handled by a broker as a middleman. This brief review is offered after investigation by the committee instead of a formal specification because it is believed that a preliminary discussion is necessary before even the foundation of a specification can be laid.

Practically speaking, there is but one ore of tin, cassiterite, which in some cases is almost pure stannic oxide. It occurs as "vein tin" in mineral lodes and as "stream tin" in alluvial deposits. Vein tin is generally associated with other minerals, while stream tin is much purer.

GEOGRAPHICAL DISTRIBUTION

Tin is found in paying quantities in very few places. The relative importance of the sources may be judged by their approximate outputs, stated below in gross tons of metallic tin per annum.

	Gross Tons
Straits	60,000
Bolivia	20,000
Banka and Billiton	17,000
Cornwall	5,000
Australia	4,000
China	4,000
South Africa	2,500
Miscellaneous	2,500
	115,000

The Straits tin comes from Penang, Singapore and Malacca, the two latter being towns on the Malay Peninsula and the former an island off the west coast

ent are also reduced and largely collected in the crude tin, from which they can be but imperfectly removed by liquation. The result is that the purity of the final product depends largely upon that of the original tin-stone, so that certain deposits have come to have a reputation as producers of high-grade tin. At this writing electrolytically refined tin is just beginning to appear on the market in quantity from the treatment of foul bullion produced in the usual way from Bolivian concentrates. Electrolysis of course should obliterate the past history of the crude tin.

MARKET

It has been the fixed policy of the Dutch and English colonies to smelt the tin concentrates at the point of production, export duties having been imposed on tin ores. Prior to the war, the Bolivian concentrates were sent to England and Germany, where they were worked into a low-grade tin. They are now coming chiefly to the United States and the crude tin obtained therefrom electrolytically refined as stated above. Up to this time it has been impossible to buy the desirable Straits and Banka products which make up the bulk of the high-grade output except upon reputation by brands, and the sales in America have been handled by brokers who are practically subject to the dictation of the Dutch-English ring controlling those brands, in spite of the fact that this country consumes 45,000 tons a year, or over a third of the world's production. The recent importation of Bolivian concentrates and their local treatment it is to be hoped will alter this situation.

According to the rules of the London Metal Exchange, tin is merchantable as standard tin only when the warrant is accompanied by analysis certifying that the metal contains either 99.00 or 99.75 per cent of pure tin, according to whether the quality is that of a common tin or refined tin, and also that it is of the correct physical condition.

Straits, Australian, English Refined, Banka and Billiton fall within the highest class, namely, refined tin. The Chinese tins are "off-grade," carrying considerable lead, and the German tins resulting from the smelting of Bolivian concentrates are very foul. Off-grade tins are sold on the basis of a sliding scale for tin content. The worst of them will run over 90 per cent tin, while the high-grade tins will run 99.8 to 99.9 per cent. The only tests required for good merchantable tin aside from its origin are that it shall run at least 99.75 per cent tin and that a bar when nicked and bent double shall not crack.

ANALYSES

The consumer has generally met the situation in

Table I—Analyses of Different Brands of Tin—All Values in Per Cent

Elements	Electrolytic*	Straits, Banka,	Billiton	Australian	English Common	English Refined	German	Chinese	Bo-
Tin	99.80-99.95	99.80-99.95	99.75-99.90	99.2	99.9	99+	95-99	93	Livian
Antimony	...	0.02	0.04	0.25	0.04	0.65	0.02-0.40	4.0	
Arsenic	...	0.04	0.06	0.06	0.05	...	0.06	0.2	
Bismuth	...	None	0.003	0.06	0.001	...	0.01	0.1	
Copper	...	0.01	0.04	0.08	0.015	...	0.09	0.5	
Iron	...	0.03	0.03	0.004	0.002	...	0.15	0.02	
Lead	...	0.02	0.04	0.36	0.01	0.14	0.3-4.0	2.7	
Zinc	...	0.03	None	0.006	0.01	...	None	0.03	

*Representative analyses of the new electrolytic tin are not available at this writing.

and in English hands. Banka and Billiton are islands in the Dutch East Indies.

METALLURGY

The metallurgy of tin is very simple in the case of the pure deposits. The ores, which run but a few tenths of a per cent in tin, are readily concentrated by ordinary wet methods to a 60 to 70 per cent product, on account of the high specific gravity of cassiterite. The concentrate is smelted in a reverberatory furnace with coal as a reducing agent and the fluxes necessary to slag the remaining gangue. The resulting crude tin is then refined by liquating and drossing. As stannic oxide is difficult to reduce, the various impurities pres-

which he finds himself by buying a first-class brand, analyzing it when he gets it, and then sorting the lots by analysis for certain uses. It is of doubtful value to give here a long list of analyses of different brands, but a rough idea of the various grades given above in Table I will illustrate the situation.

USES

The principal uses of tin, aside from tin salts and pigments, are as metal in pipe, fusible boiler plugs, etc.; as a coating, as in tin plate, tinned wire, tin-lead foil, etc.; and in an alloy, as in bronze, babbitt, solder, britannia metal, type metal, fusible alloys, etc. The bronzes are alloys with copper and zinc; babbitt metal with antimony and copper; solder with lead and a little

*Presented at the meeting of the American Society for Testing Materials, Atlantic City, N. J., June 30.

antimony; britannia metal with antimony; fusible alloys with lead, bismuth and cadmium.

ALLOWABLE IMPURITIES

The impurities in tin may cause trouble by poisoning, as in the case of pipe and tin cans; by impairing fluidity, causing an excessive consumption of tin used for coating, or making solder hard to apply; by fouling an alloy and spoiling its appearance; by impairing the ductility of alloys which have to be worked, such as bronze or britannia metal; by causing local galvanic action and possibly "tin pest;" and by affecting the melting point of fusible alloys.

In a general way the purest obtainable tin is desired for pipe and boiler plugs. The U. S. Bureau of Standards has found that zinc, generally introduced by a foul pot when remelting tin, causes serious deterioration in boiler plugs and recommends as nearly as possible absolute freedom from zinc and lead.

One of the tin-plate manufacturers states that lead makes a mottled finish, iron causes rough surface and impairs fluidity, and arsenic and zinc tend to form poisonous salts. They suggest maximum allowable percentages as follows:

Lead	0.04 per cent
Copper	0.02 per cent
Iron	0.05 per cent
Arsenic	0.05 per cent
Antimony	0.02 per cent
Zinc	0.05 per cent

One of the manufacturers of wrought bronze gives the following maximum allowable percentages:

Antimony	0.01 per cent
Bismuth	0.001 per cent
Lead	0.05 per cent
Iron	0.05 per cent

Book Review

Exporters' Encyclopaedia for 1916. Pages 1175, 5½ x 8 in. Published by the Exporters Encyclopaedia Company, 80 Broad Street, New York. Price, \$7.50, including monthly corrections and Exporters' Review.

Designated as a complete shipping guide, this volume, now in its twelfth yearly edition, contains a vast fund of information of value to all engaged in export trade or have need to post themselves on its intricacies. It contains such a wealth of detail that a complete recapitulation of its contents cannot be here attempted. The area, population, commerce and products of each country are given, as well as such information as points through which bills of lading are issued, shipping routes, cable tolls, consular charges and regulations, coinage conversion tables, location of consulates, banks and bankers in foreign trade, collection of drafts, distances, duties, packing, forwarding, freight rates, etc. The book is highly indorsed by transportation lines, export houses, forwarders and manufacturers.

Stainless Steel from a German Viewpoint

Commenting on stainless steel, a recent British invention, a German technical paper the *Metallbörse*, says that its investigations reveal that the steel is a high-grade chromium alloy containing up to 12 per cent chromium, an average analysis of one sample showing: Carbon, 0.28; manganese, 0.12; silicon, 0.01; chromium, 12.7; cobalt, 0.45; and iron, 86.6 per cent. It found the limits of elasticity and elongation to alter with the heat treatment, the former being very high, from 28 to 33 tons per sq. in. in the forged material, with the tensile strength at 44 to 55 tons per sq. in. Annealed material showed an excellent elongation, frequently exceeding 27 per cent, with a reduction of area of 50 per cent. The Brinell hardness was reported as 185, necessitating great care in forging and rolling. Although capable of resisting ordinary corrosive influences, this authority states that these alloys are attacked by 10 per cent sulphuric acid, the loss of a 10 per cent chromium alloy being 18 per cent and of a 15 per cent alloy as high as 38 per cent.

The Corrosion of Condenser Tubes

The third report of the Committee on Corrosion of the British Institute of Metals was presented at the recent annual meeting of the Institute at London. The report was written by William E. Gibbs, special instructor of metallurgy in the University of Liverpool, who was responsible for the later portion of the investigations. It also embodies work by R. H. Smith, late Wiggins scholar in metallurgy in the University of Birmingham, and Dr. Guy D. Bengough, lecturer in metallurgy in the University of Liverpool.

A preliminary note states that the work has been rendered difficult because of the war. It contains, however, 127 pages and records work done on the corrosion of condenser tubes that has been carried on at the Institute's experimental plant at Liverpool. It is divided into eight sections. The following extracts are from an abstract of the committee's work made by the London *Iron and Coal Trades Review*:

It may briefly be recorded that the sea water corrosion of ordinary brass (70 per cent copper and 30 per cent zinc) at 30 deg. C., 50 deg. C., and 60 deg. C., has been compared with that of Admiralty metal (70:29:1), a special lead-brass (70:28:2), phosphor-bronze (96:4), and aluminum-copper (92:8). It is found that aluminum-copper dissolves more slowly than the brasses. The phosphor-bronze dissolves more rapidly than the brasses. In each case both hard-drawn and annealed test pieces of the alloys were used. Generally speaking the hard-drawn metal dissolved less rapidly than the annealed, but is more readily attacked locally and selectively. Aeration of the sea water accelerates the rate of corrosion, more especially at the lower temperatures.

Corrosion in gently aerated diluted sea water (e.g., estuary water) has been examined in some detail. The rate of solution of each alloy is diminished by diluting the seawater, but the degree of selective corrosion is greatly increased. It is found that the rate of solution of pure copper is diminished by diluting the sea water, and is least in distilled water. That of pure zinc is greatly increased by diluting the sea water, and is greatest in distilled water.

Diluted sea water also facilitates the formation of deposits of oxy-salts of zinc upon the surface of the metal. These oxy-salts are found to promote local selective corrosion. In diluted sea water the phosphor-bronze is the most satisfactory of the alloys considered.

The corrosion of the above mentioned five alloys has also been examined in distilled water saturated with carbon dioxide, at 30 deg. C. and 50 deg. C., and in a 0.15 per cent solution of common salt, at 30 deg. C. and 50 deg. C. Dezincification is promoted by a low concentration of salt, and by a relatively high concentration of carbon dioxide. Contact with coke is found to promote dezincification of the Admiralty metal, provided that good electrical contact exists between the metal and the coke. Under service conditions good contact is probably the exception rather than the rule.

The influence of the surface condition of the metal has been investigated, and is shown to be important during the early stages of the corrosive attack. The corrosion of 70:30 brass has been compared with that of pure zinc and water.

The report contains a section which is devoted to a consideration of the bearing of the results of the experimental work upon the practical problem.

Some Welsh Tin-Plate Details

Tin-plate bars for use in the Welsh tin-plate industry rose from \$24 to \$58 per ton in 1915, with tin selling at one time at \$905 per ton, and with sulphuric acid very scarce. Tin plates themselves advanced from \$3.09 per box of 108 lbs. for Bessemer coke (I.C. 14x20), f.o.b. Cardiff or Swansea, to \$6.07 per box in December, 1915, the highest price since 1880, when it was \$7.78, with \$9.73 some years before. Exports to France rose from 21,332 tons in 1913 to 59,703 tons in 1915, and to Norway from 25,166 tons in 1913 to 38,510 tons in 1915. Exports to the United States in 1915 were only 1014 tons, against 21,516 tons in 1913 and 17,468 tons in 1914.

PERSONAL

Samuel M. Vauclain, vice-president of the Baldwin Locomotive Works, was presented with a silver loving cup at his home, "Broadlawn," at Rosemont, near Philadelphia, on Saturday, July 2. The presentation was made by J. P. Sykes, general superintendent of the Baldwin Works, in behalf of the employees of the Remington Arms Company and the Eddystone Ammunition Company, besides those of the Baldwin Locomotive Works, 600 of whom were present. The event was in recognition of Mr. Vauclain's thirty-third year as a member of the Baldwin organization.

Capt. Robert W. Hunt, Chicago, has had conferred upon him by the Rensselaer Polytechnic Institute, with which he has long been identified, the degree of doctor of engineering. His interest in this institution has been a very close one, and recently he contributed largely toward the cost of erecting new dormitories, at which time a portrait done by Lewis Betts was also presented to the school.

Prof. Henry M. Howe's friends have learned with pleasure of his appointment as honorary vice-president of the (British) Iron and Steel Institute. There are but two others—Prof. D. Tschernoff of Russia and Giorgio E. Falck of Italy.

Harry H. Pinney, a vice-president of the Remington Arms-Union Metallic Cartridge Company, is now in charge of the arms plant of the company at Bridgeport, Conn., retaining charge also of the ammunition plant of the company at Hoboken, N. J. Major Walter G. Penfield, general works manager, goes to the New York office to take up important special work. Mr. Pinney was formerly for four years manager of the Union Metallic Cartridge Company and has held important positions with the Westinghouse Electric & Mfg. Company, National Cash Register Company and Chalmers Motor Car Company. He was born in Glastonbury, Conn., and learned the machinist and tool-making trade with the Pratt & Whitney Company, Hartford, Conn.

L. S. Voigt, formerly mechanical engineer with the Hydraulic Press Mfg. Company, Mt. Gilead, Ohio, is now connected with the coke and by-products department of the Illinois Steel Company at Gary, Ind.

William Hugus, who has been superintendent of the Crescent plant of the American Sheet & Tin Plate Company, Cleveland, Ohio, has been appointed superintendent of the Laughlin plant of this company at Martins Ferry, Ohio, effective July 1. He has been succeeded in Cleveland by C. M. Ballou, who has been connected with the company's National works at Monessen, Pa.

Carl F. Meyer, formerly of Baltimore, will sail for Liverpool, England, July 22, where he will represent the Landis Machine Company, Waynesboro, Pa.

K. W. Zimmerschied, metallurgist, General Motors Company, Detroit, Mich., was made a life member of the Society of Automobile Engineers at its annual meeting in June in recognition of his work as chairman of the Steel Standards Committee.

H. B. McMaster, formerly general manager of branches of the Berger Mfg. Company of Canton, Ohio, has resigned to become vice-president and general manager of the Gordon Tire & Rubber Company, also of Canton.

W. D. Crawford, former president of the LaBelle Iron Works, Steubenville, Ohio, is spending the summer months at East Quogue, Long Island.

J. B. Kessler, general agent of the Carnegie Steel Company, Pittsburgh, has returned to that city after an absence of several months on the Pacific coast.

The American Steel & Wire Company, Pittsburgh, C. L. Miller, vice-president and general superintendent, announces the following appointments, effective July 1: John Wheeldon, formerly superintendent of the Cuyahoga works, Cleveland, Ohio, district, has been appointed superintendent of the South works, Worcester, Mass., district, succeeding J. F. Tinsley, resigned. G. L.

Peters, formerly superintendent of the American works, Cleveland district, appointed superintendent of the Cuyahoga works, Cleveland district. F. Ingraham, formerly superintendent of the Rockdale works, Joliet, Ill., appointed superintendent of the American works, Cleveland district. L. E. Booth, formerly superintendent of the Scott Street works, Chicago district, appointed superintendent of the Rockdale works, Chicago district. H. R. Patterson, formerly superintendent of the Trenton, N. J., works, appointed superintendent of the Scott Street works, Chicago district. B. J. Spalding, formerly assistant superintendent of the Donora wire works, Donora, Pa., appointed superintendent of the Trenton works, which are also included in the Pittsburgh district.

A. E. Bateson, assistant purchasing agent of the Allis-Chalmers Mfg. Company, Milwaukee, Wis., has been promoted to manager of the purchasing department to fill the vacancy caused by the death of William P. Harper. F. E. Haker has been promoted to first assistant. Mr. Bateson has served the Allis-Chalmers Company and its predecessors for 26 years in various capacities.

George A. Yule, who will continue to act as treasurer, has been elected president of the Bain Wagon Company, Kenosha, Wis., to succeed his father, George Yule, who died two weeks ago. William Head Yule, Akron, Ohio, was elected vice-president and J. C. Lund, formerly of Ravine, Wis., is the new secretary. The new president has been active manager of the business since 1901.

L. H. Mesker has been appointed sales manager of the Kearney & Trecker Company, milling machines, Milwaukee, Wis. He will have his headquarters at Milwaukee, but for the present will retain the direct supervision of sales in the Ohio territory.

William M. Henderson, who recently resigned as assistant superintendent of the frog, switch and signal department of the Steelton plant of the Pennsylvania Steel Company, has become assistant works manager of the Easton, Pa., plant of the Taylor Iron & Steel Company. He was with the Pennsylvania Steel Company 19 years.

John E. Ericson, supervisor of improvements at the Steelton plant of the Pennsylvania Steel company, has resigned, effective July 5, and has become associated with the Clinton N. Scovell Company, consulting engineer, of Boston, New York, Chicago and Springfield, Mass. He will be identified with the scientific management end of the work and will be stationed at Boston, where he will assume his duties July 17.

George D. Kirkham, since the first of the year representing the American Steel & Wire Company in the jobbing trade in Iowa, Wisconsin and Illinois, made his thirtieth annual vacation trip to New York and the Atlantic seaboard last week, leaving on July 1 for a short trip to Nova Scotia. His headquarters are now in Chicago, where he lived until 14 years ago, when he was given Southern territory for the American Steel & Wire Company, with headquarters in Memphis.

W. H. Mixer, vice-president Syracuse Smelting Works, Brooklyn, N. Y., has completed an extended tour about the country.

E. R. Marker, district manager of the T. L. Smith Company, maker of concrete and other mixing machinery, has moved to new quarters at 609 Wells Street, Milwaukee, Wis., where he will take charge of the business of the company as Wisconsin representative. He will carry a stock of contractors' supplies.

Herman Nieter, formerly sales manager for the Kenicott Company, Chicago, and later manager of the New York office of the Blaw Steel Construction Company, is now sales engineer with the American Spray Company, 26 Cortlandt Street, New York, engaged in installing water and air cooling systems and gas and fume cleaning systems.

E. H. Collister has been appointed superintendent of the new Koppers by-product coke plant of 94 ovens now being built by the LaBelle Iron Works, Steubenville, Ohio.

F. J. Denk of the Steel City Engineering Company, House Building, Pittsburgh, has been appointed con-

sulting engineer for the Phoenix Glass Company, Pittsburgh and Monaca, Pa.

A. C. Niemann of the sales force of the Gisholt Machine Company, Madison, Wis., has been transferred to the New York office of the company as an assistant to R. D. Heflin, manager.

D. N. Barker, in charge of the Chicago branch office and warehouse of the Jones & Laughlin Steel Company, resigned July 1 after 44 years of service. He has been succeeded by S. E. Hackett, formerly with Joseph T. Ryerson & Son, Chicago, in charge of purchases. Mr. Barker will retire from active business.

William T. Todd, Jr., has been added to the selling force of the Somers, Fitler & Todd Company, Pittsburgh. He graduated from Cornell University in June as a mechanical engineer.

Wallace R. Johns has been appointed manager of the machine tool department of the Somers, Fitler & Todd Company, Pittsburgh. He has been connected with the company for the past eleven years.

Midvale Establishes New Office Department

A. C. Dinkey, president Midvale Steel Company, announces that in order to expedite the handling of orders it has been decided to organize an order and shipping department, located in the Widener Building, Philadelphia, under John C. Neale, general manager of sales, who has appointed F. H. Lewis as manager of orders. The purpose of the department is to receive orders from the sales department and place them at the various mills for execution.

It is not the intention, for the present at least, to make the actual mill entry in the Widener Building, but copies of all mill orders will be on file at this point, and all original orders will be returned here after proper entry has been made. The department will be in position at all times to give full and complete information regarding shipping matters, and will be responsible for keeping promises made to customers.

All correspondence regarding shipment of orders, changing of orders, etc., in the case of the Midvale Steel Company and Worth Brothers Company should be addressed to F. H. Lewis, manager of orders, Philadelphia, from which point answers will be sent. In the case of the Cambria Steel Company, all mail pertaining to orders should be addressed to F. H. Lewis, manager of orders, Widener Building, Philadelphia, with a copy to F. E. Thompson, superintendent of order department, Johnstown, and reply will be sent direct from Johnstown, with copy, to Philadelphia.

Another Electric Steel Plant

The Crucible Steel Forge Company, Cleveland, Ohio, will build a new plant, and will make electric steel for use in its forge shop. A Roechling-Rodenhauser induction furnace of two tons capacity will be installed for making steel of the higher qualities and alloy steels. After the first furnace is in operation the company plans to install a similar furnace of larger capacity. The company's new plant will be located in Newburgh, on the Belt Line Railroad, and will occupy a building about 45x400 ft. Its products are alloy and tool-steel forgings. A new forging press and several hammers will be installed. Its forging capacity will be trebled, and its furnace capacity will be four or five times that of the present plant. The company's electric furnace will be the third of this type to be installed in the United States, two having recently been started at the plant of the American Iron & Steel Mfg. Company, Lebanon, Pa.

The annual meeting of the directors of the Barney & Smith Car Company, Dayton, Ohio, was held in that city June 30. All of the old officers of the company were elected as follows: President, H. M. Estabrook; first vice-president and general manager, A. J. Stevens; second vice-president and treasurer, J. Frank Kiefaber; secretary and assistant treasurer, E. A. Oblinger; assistant secretary, E. H. Sines.

Providence Engineers' Annual Meeting

Reports read at the annual meeting of the Providence Engineering Society, Providence, R. I., held in the Engineering Building, Brown University, June 28, showed that the society had made rapid strides in growth and influence in the few months since its formation. In the afternoon, through the courtesy of F. E. Winsor, chief engineer of the Water Supply Board of Providence, about 120 members of the society enjoyed a view of the site and the preparatory work of the engineers of the big reservoir now under construction in the town of Scituate. This project will take several years to complete, and will furnish a dependable and pure supply of water calculated to take care of the city's needs for forty or fifty years.

At the conclusion of the tour of inspection, the members dined at the University Club and then adjourned to the Engineering Building. Here Mr. Winsor gave an illustrated talk on the Scituate water supply. G. T. Seabury, an engineer of the Water Supply Board, in charge of field operations, gave an interesting account of the method of making borings and the facts so far discovered in the work. F. E. Waterman, another member of the engineering staff engaged on the reservoir work, gave a rather humorous description of the difficulties involved in determining real-estate values and ownership.

R. A. Annan, Rhode Island Tool Company, retired president, discussed the future of the society, and received a rising vote of thanks for the fine work he had done in bringing the society into existence and in guiding its affairs during its formative days. Prof. J. Ansel Brooks, Brown University, was elected president, and the other officers chosen were: Vice-presidents, R. W. Adams, General Electric Company; G. A. Carpenter, city engineer, Pawtucket; W. T. Robertson, architect. Corresponding secretary, A. E. Thornley, Narragansett Machine Company; recording secretary, W. C. Kennedy, General Fire Extinguisher Company; treasurer, A. E. Whatley, consulting engineer; councilors for three years, F. E. Winsor, R. E. Brunet, W. C. Pickersgill and L. Earle Rowe.

Eighty-one applicants were voted into membership and 66 applications were received. These bring the total membership to 487.

Mechanical Engineers' Annual Meeting

The valuation of industrial property will be the feature of the annual meeting of the American Society of Mechanical Engineers, to be held in the Engineering Societies Building, 29 West Thirty-ninth Street, New York City, Dec. 5 to 8. Among the topics to be considered are: Actual Appraisals by Short Methods; Does Valuation of Industrial Property Differ from Public Utility Valuation; Relation Between the Perpetual Inventory Value and Appraisal Value; Engineering Economics of Partial Construction dealing with piecemeal construction—how such construction is regarded in appraisals, Amortization and Depreciation. There will also be the usual sessions under the auspices of the railroad, machine-shop practice and gas-power subcommittees, together with a number of miscellaneous papers.

The 1917 spring meeting of the society will be held at Cincinnati. The exact date has not yet been definitely settled.

Holden A. Evans has been elected president of the Baltimore Drydocks & Shipbuilding Company, Baltimore, Md. The other officers are Clement C. Smith, Milwaukee, Wis., vice-president; J. M. Willis, Baltimore, second vice-president; Edwin W. Poe, Baltimore, secretary; George Allison, Baltimore, treasurer. The controlling interest of the company was recently taken over by Milwaukee interests. Mr. Evans was formerly general manager.

P. F. Burke, South Boston, Mass., has sold his patent steel toe-calk and horseshoers' foot vise business to the Franklin Steel Works of Joliet, Ill., and Cambridge, Mass.

STRIKES AND SETTLEMENTS

The Situation at Milwaukee

The controversy between employers and operatives in the metal-working industry in the Milwaukee district over the 8-hr. day was brought to a climax July 1 by the announcement of a reduction of 2½ hr. in the time per week, or from 55 hr. to 52½ hr., at the present hourly rate of pay. The present schedule of hours will continue, but overtime will commence from 52½ hr. instead of 55 hr. The announcement followed the conclusion of an exhaustive investigation of the hours-of-labor situation in competitive industries in the Middle West under the direction of the Industrial Commission of Wisconsin, at the request of 35 Milwaukee employers. Although the investigation shows that the working time in a majority of competitive shops is 55 hr. and over per week, the Milwaukee employers voluntarily reduced the hours per week.

Whether or not the organized machinists will accept the 52½-hr. week as a compromise of their demand for an 8-hr. day at the present 9-hr. pay remains to be seen. A few days ago the representatives of the unions announced at a mass meeting that, unless the employers acceded to the demand for an 8-hr. day before July 7, a strike would be inevitable. The effect of the voluntary reduction in hours is therefore awaited with deep interest.

In the investigation, conducted for the commission by Edwin E. Witte, University of Wisconsin, statistics were obtained from 983 shops of competitive industries in the Middle West, employing 93,540 people. Thirty-eight per cent of the shops are working less than 54 hr. per week, while 62 per cent are working 55 hr. or over per week. Twenty-two per cent are working less than 54 hr. per week and 78 per cent are working 54 hr. or over per week. In order to appreciate the comparison, it should be understood that the metal-trades shops in the Milwaukee district have been on a 55-hr. basis. The report shows further that, on the basis of employees, 50 per cent of the 93,540 operatives are working less than 55 hr. per week, and 50 per cent are working 55 hr. or over per week. Thirty-six per cent are working less than 54 hr. per week, and 64 per cent are working 54 hr. or over per week.

The 35 industries affected by the investigation and hours-of-work reduction are the largest employers in the Milwaukee district, and include machinery, machine-tool, crane, motor-truck, lubricating and counting machinery manufacturers and all lines of the foundry business.

Other Localities

The strike fever in New England seems to be nearly over. No disturbances of any prominence have been reported the past week and conditions where trouble has existed are fast approaching normal. The plant of the Plume & Atwood Mfg. Company, Thomaston, Conn., reopened June 27 and the strikers are rapidly resuming their places. The factory was opened under the conditions previously offered to the strikers as a compromise. The minimum wage will be 25c. an hour and other wages will be raised to correspond; time and a half will be paid for overtime and the weekly working schedule will be 55 hr. The striking brass molders at the Russell & Erwin division of the American Hardware Corporation, New Britain, Conn., have nearly all returned to work, having accepted an offer which they had some time ago refused, of a 5 per cent bonus after a stated day's wages have been earned. The directors of the Colt's Patent Firearms Mfg. Company, Hartford, Conn., have voted to continue the bonus payments to employees for another six months. Bonuses are paid every three months and average about 12½ per cent of the net profits of the company.

Employees at the Carnegie Steel Company's plant, Bush and Wicomico streets, Baltimore, Md., went on strike last week, demanding an 8-hr. day, an increase of 10 per cent in wages and time and a half for overtime work.

The labor situation at Cincinnati, Ohio, is about normal as far as the local machine-tool plants are con-

cerned, and only a few plants are still being picketed. An arrangement effected last week between the local street railway company and its employees has set at rest rumors that a strike would be called this summer. At Hamilton, Ohio, one large machine shop is still having some trouble, although most of its men who went out eight weeks ago have returned to work. In Dayton, Ohio, unskilled workmen in one plant caused some inconvenience last week, but the supply of this class of men is in excess of the demand and the trouble was speedily adjusted.

A general strike of organized machinists in Philadelphia and vicinity was called July 1 by the International Association of Machinists. The union is demanding an 8-hr. day. No demand is made for wage increases. According to the officers of the union, about 7000 machinists have answered the call, but these figures are disputed by employers. Sixty-eight concerns in Philadelphia and vicinity, employing machinists and other metal workers, have published a statement that they are unable to grant the shorter workday.

The most serious of the many problems confronting manufacturers in the extreme Northwest is the continuance of labor troubles in all Pacific coast ports. The big strike of several weeks ago had been settled only a few days when it broke out anew, and the Puget Sound and Columbia River ports are now paralyzed by strikes of longshoremen and union dock workers. The coastwise trade is absolutely idle, and tidewater lumber mills specializing in coastwise markets report rapidly congesting docks, with little hope of immediate remedy. Many carloads of machinery for mills in Oregon and Washington routed north by sea from San Francisco, have been held up at that port, pending settlement of the strike.

Steel Bar and Barb Wire Exports

The contributions of this country to the war continue to mount to higher figures. The following table of Government data shows our exports of steel bars and barb wire to be very much greater now than at any previous time:

	Steel Bars		Barb Wire	
	Gross Tons	Tons Per Month	Gross Tons	Tons Per Month
January, 1916.....	58,400		33,962	
February, 1916.....	53,891		29,577	
March, 1916.....	57,111	56,904	37,242	32,117
April, 1916.....	58,215		27,689	
Last quarter, 1915..	129,666	43,222	75,732	25,244
1915	426,002	35,500	248,619	20,718

Steel bar exports are now at the rate of 682,848 tons per year, judged by those for the first four months of this year, a 50 per cent increase over those for 1915. Barb wire exports, based on the average of 32,117 tons per month to May 1, 1916, are at the rate of 385,404 tons per year, also an increase of 50 per cent over the total for 1915.

Great Britain's exports of steel bars in 1915 were 489,464 gross tons, which was less than our present rate.

Larger Imports of Manganese Ore

Imports of manganese ore into the United States in April were 48,413 gross tons, the largest this year. This brings the average to May 1, 1916, up to 24,989 tons per month, which compares with 26,731 tons per month in 1915 and 28,757 tons per month in 1913. For the 10 months to May 1, 1916, the total imports have been 355,795 tons, against 159,203 tons and 242,748 tons for the same periods in 1915 and 1914, respectively. The present rate is above the five-year average. In April, 1915, the imports were only 218 tons.

The Woodard automatic safety exit doors are to be manufactured by the Up-To-Date Mfg. Company, 945 North Tenth Street, Terre Haute, Ind., which company has secured manufacturing and selling rights in the United States territory from the patentee of the door, C. B. Woodard, Springfield, Tenn. The door, it is understood, has the official approval of the committee on standards of the New York City fire department and of the American Society for Fire Prevention.

Pittsburgh and Nearby Districts

The recently organized United States Electrical Steel Company, which proposes to build a steel plant at South Connellsville, Pa., will not install sheet mills, as has been reported. The company will make high-grade electric steel in either plate or billet form. The only contract placed so far is for a 10-ton Grönwall-Dixon electric furnace. The remainder of the equipment will be bought in the near future.

James A. Campbell, president Youngstown Sheet & Tube Company, Youngstown, Ohio, denies reports of a proposed merger of his company and the Inland Steel Company of Chicago. No negotiations of any kind are on at present looking to a merger of the Sheet & Tube Company with any other interest.

The Pressed Steel Products Company, manufacturer of drawn, stamped and spun-metal specialties, Sharon, Pa., will erect a new building of mill construction, 60x200 ft., one story, for the manufacture of steel drums for carrying oil.

The Wilkes Rolling Mill Company, Sharon, Pa., whose plant has been idle for a long time, may put it in operation at an early date. The plant has puddling furnaces, and its output is muck bar only.

The Pennsylvania Railroad is stated to be having a satisfactory experience with its 70-ton steel cars, which have been in commission for some months, and will build more. In fact, it has out an inquiry for 5000. The car itself weighs 57,600 lbs., and its length is 47 ft.

The Harrison-Walker Refractories Company, Pittsburgh, for the six months ended March 31 reports a surplus after all charges and dividends of \$739,534. This compares with a surplus of \$562,889 for the entire previous fiscal year. The statement for six months shows earnings after expenditures, \$1,714,972; extraordinary expenses, \$327,438; net profits, \$1,387,534; dividends on preferred and common, \$648,000; surplus, \$739,534.

The American Lead Company, Pittsburgh, will increase its capital stock from \$100,000 to \$300,000.

The H. C. Frick Coke Company, Pittsburgh, has sold 52 acres of land in East Huntington Township, Westmoreland County, to the United States Cast Iron Pipe & Foundry Company for a consideration of \$7,587.

The LaBelle Iron Works, Steubenville, Ohio, has made application to list on the Pittsburgh Stock Exchange \$3,500,000 5 per cent gold bonds. This is part of an issue of \$7,000,000 in 5 per cent gold bonds, authorized by this company some time ago, but only half of which was sold. The proceeds will be used largely in the building of a steel bridge across the Ohio River from the West Virginia side to Steubenville, and also in payment for 94 Koppers by-product coke ovens, now being built, and which will be completed in a few months.

Reports that the American Steel & Wire Company, of Pittsburgh, is the purchaser of the old Zug & Co. property, formerly known as the Sable Iron and Steel Works, at Thirteenth and Etna streets, Pittsburgh, are incorrect, as it has neither bought the property nor tried to purchase it. It is believed, but not confirmed, that the property was bought by the Pennsylvania Railroad Company.

The Driggs-Seabury Ordnance Company, Sharon, Pa., has received an order from the United States Government for 2550 Lewis machine guns.

Herbert Du Puy, chairman of the Crucible Steel Company of America, Pittsburgh, denies that his company has recently received an order for \$4,000,000 of munitions from the United States Government; and he further states that his company has not received any orders from the Government or munitions since Jan. 15 last.

The North East Foundry & Machine Company, manufacturer of gray iron and semi-steel castings, North East, Pa., was recently organized and has elected the following officers: President, J. J. Finerty, Buffalo, N. Y.; vice-president and general manager, F. G. Pottmeyer, Midland, Pa.; secretary and treasurer, E. A. Finerty, Midland. It has purchased the property

formerly owned by the North East Foundry Company at North East, Pa., and will begin operations July 5, 1916, producing light miscellaneous castings, and also intends to specialize in tube mill castings and split molds for crucibles. F. G. Pottmeyer, manager, formerly assistant superintendent of the Pittsburgh Iron & Steel Foundries Company plant at Midland, Pa., is making extensive alterations, also installing new equipment in the machine shop and foundry. E. A. Finerty, secretary and treasurer, comes from the Pittsburgh Crucible Steel Company. Among the stockholders of the new company is J. J. Finerty of Buffalo, N. Y.

The Lakeside Forge Company, maker of drop forgings, Erie, Pa., has just started an addition to its machine shop, 75 x 80 ft., at a cost of about \$10,000, to provide additional capacity for the manufacture of wrenches. The company has recently installed a number of new hammers and otherwise greatly increased its equipment.

The Jones & Laughlin Steel Company is rebuilding its No. 11 merchant steel bar mill at its South Side works, Pittsburgh, which when completed will have an output of about 8000 tons per month. The company has added in the past year one Bessemer converter at its South Side works and one at its works at Aliquippa, Pa., which give the company a total of about 15,000 more tons of Bessemer steel per month. This increased steel output will be used largely in the new bar mill and also in the new skelp mills which are being built at Aliquippa, and which will be making skelp about Sept. 1.

The New British High Speed Steel

Our London correspondent sends the following concerning the new non-tungsten high speed steel, referred to in THE IRON AGE, June 29, 1916:

A new steel alloy known as Reactol, and produced at Sheffield, is arousing a good deal of interest in England among makers of high-speed tool steel. It is said that it contains neither tungsten nor cobalt, and that it requires neither forging, hardening nor tempering, but merely has to be ground into shape in order to make it ready for work of the heaviest character. Very high service claims are made for it.

As is well known the greatest drawback to the use of high-speed tools is the length of time it takes to make them. It is claimed for Reactol that it does away with nearly all of this, thus saving large sums in material, plant and labor. In a recent test it was found impossible to rough a shell in less than 14 minutes by the employment of ordinary high-speed steel tools, but Reactol is reported to have roughed 5 similar shells in 9 minutes. It may be stated that the Reactol alloy has been invented purely for high speeds and heavy cuts. Therefore, it would be almost impossible to use it on low-speed machines unless, of course, they possessed very heavy feeds. Experiments are being made in England with tools made from this new alloy, but the various rates at which they can be run are unknown at present.

Ohio Works Get New Shell Orders

The Barney & Smith Car Company, Dayton, Ohio, has received an order for forging approximately 2,000,000 shells for the British Government ranging in sizes from 3½ in. to 6 in. Work will be commenced immediately and the contract is expected to be completed before the end of the year. This company has recently completed the delivery of 3,000,000 shrapnel shells for the Russian and French governments. It is estimated that its new order will require approximately 50,000 tons of steel bars.

Another shell order has also been placed recently in southern Ohio, calling for approximately 300,000 shells ranging from 6 in. to 9.2 in., all for shipment this year.

The Poese Machinery & Mfg. Company, Cleveland, Ohio, announces that in the future it will be known as the American Speed-Machinery Company.

Machinery Markets and News of the Works

RESALE TOOLS APPEARING

Offers Follow Ending of War Contracts

Current Domestic Orders Keep the Trade Comfortably Busy—General Electric to Purchase Several Tools

Lists of machine tools are now being quite extensively offered for resale by munition manufacturers, most of whom have been engaged on contracts for shrapnel and small-sized high-explosive shells. On the other hand important new business is reported from Chicago from firms who have taken some of the recently placed shell contracts, and are actively gathering together special machinery and more powerful tools for making the large high-explosive shells.

The large export orders for motor trucks are also said to be nearly completed; nevertheless all through the Central West truck makers are busy and continue to buy machine tools, although not in large quantity.

Deliveries on standard tools are easier. Domestic inquiry is a little irregular; but it still keeps sellers in a comfortable position. The demand for large-sized machine tools is better, especially for planing, boring and radial drilling machines.

The railroads remain averse to entering the market for equipment while it is at its present high level. This condition is general not only throughout this country, but also in Canada. The Pennsylvania Railroad has issued a good inquiry for lathes for its Altoona shops. This is about the only attractive new business from these sources.

The first let-up in industrial expansion in New England within two years is noted, and is attributed not to any measureable slackening in production, but to the scarcity of labor and the exorbitant wages paid for unskilled workmen. Some noteworthy construction work is being undertaken in the Chicago district, where the Pullman company is reported to be having plans drawn for shop buildings to cost \$3,000,000, and the Moline Plow Company of Rock Island, Ill., has announced plans for additional plant construction to cost about \$1,000,000.

The General Electric Company has issued a rather extensive list of equipment.

New York

NEW YORK, July 5, 1916.

Dealers in machine tools are beginning to receive lists of machines offered for sale by firms which have completed or nearly completed their contracts for shells. Practically all of them made shrapnel and the smaller sizes of high explosive shells.

The American Locomotive Company has cleaned up its contract, and it is reported that the company will send some of the vast amount of equipment it purchased several months ago to its plant at Montreal, Canada, a part will be retained and the remainder will be placed on the market.

The Worthington Pump & Machinery Corporation, New York, the International Arms & Fuse Company, Bloomfield, N. J., and the Traylor Engineering & Mfg. Company, Allentown, Pa., are also reported to have machines to sell, one or two in fact having issued lists of the tools of which they wish to dispose. In one case a complete fuse plant is offered for sale.

The Canadian Car & Foundry Company states that it has shipped about 1,500,000 of the 5,000,000 shrapnel shells ordered by the Russian Government. Shipments to date total about \$22,000,000. It is expected that the total contract, amounting to about \$85,000,000, will be completed by Nov. 1. About 30 companies took sub-contracts from the Canadian Company. Component parts of shells are being delivered at a fast rate, as they have been for some time.

The J. L. Mott Company, Trenton, N. J., and the General Electric Company, Schenectady, N. Y., are figuring on a contract for steel fuse contracts, but there is not much new business in shells or parts, outside of the larger sizes in which the regular manufacturers of munitions are chiefly interested.

Roe & Brundage, 29 Broadway, New York, mill representatives, are making inquiry for shops which can machine fuses, the material being furnished by Roe & Brundage.

Frank Searle, 120 Broadway, New York, representing the British Ministry of Munitions, has for some time been the most important buyer for Great Britain. He has an elaborate suite of offices in the Equitable Building. Russian representatives continue to buy.

Domestic inquiry is a little irregular, but keeps sellers in a comfortable position. The Pennsylvania Railroad has issued a good inquiry for turret lathes for its Altoona shops. The Bijur Motor Lighting Company, Hoboken, N. J., is in the market for about 12 similar machines.

The General Electric Company, Schenectady, N. Y., is inquiring for a number of machines, in addition to those on which estimates were asked recently. Included in the new list are boring mills, large turret and engine lathes.

The Driggs-Seabury Ordnance Company, Sharon, Pa., manufacturer of rapid fire guns, shells, trench digging machinery and munitions generally, has been almost a steady buyer of machine tools of late.

A busy industrial center has been created in that section of Newark at Newark Transfer near Avenue R and Newark Bay. At one time a marsh, it has been converted within the past 18 months into a large manufacturing district, representing invested capital estimated about \$20,000,000, and employing several thousand men. Its expansion has been even more remarkable and is due to the great demand which has been created in this country for chemicals. The Balbach Smelting & Refining Company and the Texas Oil Company have been located in this section some time. Among the newer additions to the colony are the American Synthetic Dyes Company, Marden Orth & Hastings Company, aniline dyes; the Public Service Railway Corporation, the Aniline Company of Newark, the Columbus Crystal Company, the Amalgamated Dyestuff & Chemical Works, the Keystone Company, the Rockwell Furnace Company, the Central Dye & Chemical Company, the Harrison Chemical Company, and the Sun Oil Company.

The Levering & Garrigues Company, 552 West Twenty-third Street, New York, has been awarded the structural contract for a one-story brick and steel factory, 46 x 215 ft., at Plainfield, N. J., for the Niles, Bement, Pond Company, 111 Broadway, New York, from plans by Harris & Richards, Drexel Building, Philadelphia, Pa., architects. It will cost about \$25,000.

The Berlin Construction Company, 220 Broadway, New York, has the general contract for a one-story brick and steel chemical building, 50 x 84 and 50 x 75 ft., on the Shore Road, for the Oakland Chemical Company, 10 Astor Place, Rossville, Staten Island, N. Y., from private plans, to cost \$25,000.

The Valley Forge Cutlery Company, 101 Duane Street, New York, is building a two-story addition to its plant at 24 South Sixth Street, Newark, N. J., 50 x 90 ft., to be used for increasing its production of pocket knives. Work will be completed about Aug. 1 and full operations will be started shortly after. Gilbert C. Higley is the architect. Considerable special equipment will be installed.

The E-Z-Fit Artificial Limb Company, 7 East Forty-second Street, New York, recently incorporated with a capital stock of \$25,000, has established a plant. Victor G. Aubry is president, H. Egli, vice-president, and Albert G. Follett, secretary and treasurer.

The Union Tank Line Company, 26 Broadway, New York, plans to erect at Olean, N. Y., a new car repair shop, of steel construction, 80 x 150 ft., to take two tracks, and have

a weekly capacity of about seventy-five cars, also a storehouse and office 25 x 120 ft. H. J. Bonhoff is foreman.

The U. S. Electro Galvanizing Company, 1 Park Avenue, Brooklyn, N. Y., manufacturer of automatic electro-galvanizing and plating equipment, is having plans drawn by W. J. Conway, 400 Union Street, Brooklyn, for the construction of an extension to its factory to cost about \$8,500. L. Potthoff is president and Mason I. Doyle, assistant manager.

The Lockport Glass Company, Lockport, N. Y., will erect an addition, 60 x 400 ft., to its plant on South Niagara Street at a cost of about \$50,000. It will be of steel and concrete, two stories. The company will add 150 men to its present force of 200.

The North East Electric Company, Rochester, N. Y., will build an addition to its plant, 44 x 121 ft., to cost with equipment \$80,000.

The Barcalo Mfg. Company, Louisiana Street and the Erie Railroad, Buffalo, manufacturer of brass and iron beds, has let contract for a further addition to its factory, 90 x 106 ft., of reinforced concrete, to cost \$25,000.

The Wetzel Mechanical Stoker Company, Port Jefferson, N. Y., capitalized at \$15,000, has been incorporated by T. M. McGrath, C. S. Yawger and F. C. Williams to manufacture stokers, general hardware and operate a general foundry.

The Mohegan Tube Company, Long Island City, N. Y., has let contract for erection of a manufacturing plant on Davis Street, 100 x 250 ft.

The Covert Motor Vehicle Company, Lockport, N. Y., will add to its plant a two-story grinding building, 30 x 65 ft., of brick and steel.

The King Sewing Machine Company, Buffalo, has let contract for a one-story addition, 60 x 80 ft., to foundry at its plant at Rano Street and the Lackawanna Railroad.

The foundry additions to be made to the plant of the American Locomotive Works, Schenectady, will be 100 x 175 ft.; 55 x 200 ft., and 55 x 200 ft., one story. Construction contract has been let at \$85,000.

The Elderfield-Hartshorn Hardware Company, Niagara Falls, N. Y., has plans in preparation for a manufacturing plant to be built at Lockport, N. Y.

The Endicott-Johnson Company, Johnson, N. Y., shoe manufacturer, has plans in preparation for an electrical shop, 50 x 101 ft., one story and basement, to be added to its plant.

Philadelphia

PHILADELPHIA, PA., July 3, 1916.

Manufacturing firms in this city are reported to have applied recently to the United States army recruiting station to send them all men between 18 and 30 years old who have been rejected by the recruiting officers. It is said the firms will pay the men from \$3.50 to \$5 a day.

Virtually every industry in Eddystone is hampered by the lack of labor, both experienced and inexperienced. The Baldwin Locomotive Works has for weeks been advertising for labor, the Remington Arms Company is advertising for 200 inexperienced men, in addition to men skilled in various lines. The Eddystone Mfg. Company also has been advertising for weeks for men and girls. Men are needed so badly that this company, which operates the Eddystone Print Works, is offering as an inducement "light, airy sleeping apartments with all conveniences for 50c. a week." The Eddystone Ammunition Corporation is employing men as rapidly as they can be found. The only handicap faced by the Eddystone factories is the inability to get experienced workmen.

Orders estimated to cost more than \$150,000,000 are now held by Eddystone manufacturers. One year ago the town had a few industries, employing but little in excess of 3000 men. To-day it boasts of more than 25,000 well-paid wage earners. It is producing motor tractors for army transports for the Russian Government, truck engines for the French Government, shells and shrapnel for England, Russia and France; army rifles for these allied powers, textiles, structural steel and locomotives.

The Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa., for some time has been negotiating for the purchase of a large tract of land in Tinicum township, near Chester, Pa. The company has finally secured an option on 440 acres at this place, the land having a frontage on the Delaware River between Essington and Lester. It is part of the estate of W. W. Hill. In case the company purchases this property, which it probably will, it has made no plans thus far for putting any manufacturing plants on it. What will be done with the property will be decided in the future; but for the present no active work of any kind will be started.

The Leeds & Northrup Company, 4901 Stanton Avenue, Philadelphia, Pa., manufacturer of pyrometers and electrical measuring instruments, is about to erect a four-story addition to its plant, 50 x 100 ft., of reinforced concrete and brick, which will somewhat more than double its capacity. Plans are being prepared by Morris & Erskine, Crozer Building, Philadelphia.

The Philadelphia Ship Repair Company, Mifflin Street Wharf, Philadelphia, manufacturer of steering engines, has purchased an irregular plot of land extending from Delaware Avenue to Vandalla Avenue, adjoining its present plant, for about \$75,000. The new tract will be the site of a large addition to the plant. Francis J. McDonald is president.

William R. Warner & Co., 639 North Broad Street, Philadelphia, have had plans drawn for six-story factory, 180 x 200 ft., estimated to cost \$300,000. The William R. Steele & Sons Company, 1600 Arch Street, Philadelphia, is the engineer and builder. It is stated the company also contemplates the erection of another six-story building to cost \$75,000.

Announcement has been made that the Pyrites Company, Wilmington, Del., intends to erect another building to cost about \$18,000. This will bring the investment up to about \$100,000.

New England

BOSTON, MASS., JULY 3, 1916.

For the first time in nearly two years a general lessening of factory building and new business enterprises in New England is noted. This pause does not seem to indicate any measurable slackening in production. The most important factor is probably the scarcity of labor and the abnormal wages which must now be paid to secure even unskilled workmen. The rapid increase in domestic orders is compelling many manufacturers to discontinue the special work they have been doing to help the munitions plants. The general trend indicates continued high production, but along nearly normal lines.

In most metal-working centers announcements have been issued that the usual annual shutdown for vacations and repairs will not be possible this year owing to the pressure of business. Some manufacturers, however, will not allow this condition to break up their long-established custom of closing down for a week or more in midsummer. The Brown & Sharpe Mfg. Company, Providence, R. I., has issued a notice that its plant, except the offices, will shut down from July 28 to Aug. 8.

The appropriations recently made for war supplies are already making themselves felt in this section. The vote for \$5,000,000 to manufacture army rifles has brought joy to Springfield, Mass., as it is believed it means the resumption of full production at the Springfield Arsenal which is equipped with machinery to turn out 450 rifles in 8 hr., but is now turning out only 75 rifles a day with a working force of 540 men. No machine guns have been made at this plant for two or more years and it is hoped that the production of these arms may be resumed so that the number of employees may be increased to 2000 or more. The Locomobile Company, Bridgeport, Conn., has received large orders from the Government for motor trucks for the Mexican border and is quoted as stating that it is not seeking foreign orders, as domestic demand for trucks and pleasure cars is keeping it busy.

The Barnes & Kober Mfg. Company, New Haven, Conn., with a plant at Milldale, Conn., has changed its name to the B. & K. Mfg. Company and increased its capital stock from \$200,000 to \$500,000. It will move its business to New Britain, Conn., where a factory has been leased from the Hartford Automobile Parts Company. James H. Carney and John H. Trumbull, of the latter company, are stockholders in the B. & K. Mfg. Company and are on the new board of directors. Bayard Barnes, New Haven, is president and Frederick Brewster, also of New Haven, is secretary. Mr. Carney will be general manager of both companies.

The Standard Brass & Copper Tube Company, New London, Conn., has purchased the plant which it has been occupying for several years under lease.

The Smith & Winchester Mfg. Company, South Windham, Conn., is receiving bids for a factory, 30 x 130 ft., one story.

The Ever Ready Tool Company, Bridgeport, Conn., will build a factory at Railroad and Iranistan avenues, 42 x 92 ft., one story.

The F. B. Shuster Company, New Haven, Conn., has let a contract for an addition, 24 x 60 ft., with an ell, 38 x 38 ft.

The Abbott Ball Company, Elmwood, Hartford, Conn., has let contract for two additional buildings. George E. Abbott is general manager.

The S. W. Card Mfg. Company, Mansfield, Mass., is having plans drawn for an addition, 60 x 150 ft., four stories.

Barrett Brothers, Inc., Boston, Mass., general machine shop and castings manufacturer, has been incorporated with capital stock of \$10,000. Edward A. Carroll, 675 Boylston Street, is president and treasurer, and H. M. Cook and W. N. Buffum are other directors.

The American Valve Tool Company, Plainville, Conn., has awarded a contract for a factory, about 40 x 60 ft., to be erected in the Marion District.

The Boston Machine Screw Company, 133 Oliver Street, Boston, Mass., has awarded a contract for a factory, 50 x 147 ft., one story, to be built at Tudor and Emily streets, Cambridge, Mass.

The Arrow Electric Company, Hartford, Conn., has bought the factory which it occupies at 103 Hawthorn Street from the Hartford Chamber of Commerce Building Association.

The Superior Corundum Wheel Company, Waltham, Mass., is to build an addition, 45 x 60 ft., one story.

Baltimore

BALTIMORE, MD., JULY 3, 1916.

The Baltimore & Ohio Railroad Company, Baltimore, has awarded a contract for the construction of its new pier to H. S. Kerbaugh, Inc., 723 Munsey Building, Baltimore. It is estimated to cost \$500,000.

Levering Brothers, Baltimore, Md., iron founders, have purchased a tract of land with buildings at Hanover, Pa., extending along the Western Maryland Railroad from the York Railway Bridge to Broadway. No announcement of further building operations has been made.

Prices on a Corliss engine, 12 x 30 in., are being sought by the Harvey Company, 113 South Street, Baltimore.

A new power and electric light plant will be erected at St. Michaels, Md., by the city authorities.

With \$3,000 capital stock the Porter Chemical Company, Hagerstown, Md., has been incorporated by John J., Harold M. and Edith F. Porter, all of Hagerstown.

Hackley Morrison, Richmond, Va., is seeking prices on motors of various types.

A large number of private garages and a motor repair shop will be built by A. T. Hofheimer, Norfolk, Va.

Improvements will be made at the machine shops of W. S. Forbes, Richmond, Va.

The capital stock of the Richmond Forgings Company, Richmond, Va., has been increased to \$500,000.

Chicago

CHICAGO, ILL., July 3, 1916.

The important new business has to do with the buying of additional equipment by manufacturers who have taken some of the recently-placed shell contracts. While most of these contracts have been placed with interests who have had previous orders and have had most of their equipment, a demand has been created for special machinery and for more powerful tools necessary to the making of the larger sizes of shells. In the normal industrial trade a fair amount of equipment in small lots is being purchased, although the aggregate volume of business is less than it has been in recent weeks. Railroad inquiry still outstanding is very slow to close and no new lists have appeared.

The Pech Foundry Company, LeMars, Iowa, has about completed the construction of an addition, 60 x 150 ft., to be used as an automobile repair shop, storeroom, etc.

Plans for shop buildings and crane runways, estimated to cost \$3,000,000, are being prepared by the Arnold Company, architects, engineers and contractors, 15 South La Salle Street, for the Pullman Company, 79 East Adams Street, Chicago.

The Herschfield-Piper Foundry & Machine Company, Chicago, has been incorporated by R. L. Wenstrand, Joseph Solari, 332 South Michigan Avenue, and J. E. Lee.

The Midland Metal Company, Chicago, has been incorporated with a capital of \$25,000 by Thomas J. Dee, 5 South Wabash Avenue; Walter Y. C. Hunt and Harry E. Radix.

The Shanklin Mfg. Company, Springfield, Ill., will build a factory, 50 x 180 ft., to cost \$10,000. It manufactures brass novelties.

The General Refractories Company, Trinity Building, New York, will build a plant at Joliet, Ill., work to be started at once.

The Moline Plow Company, Rock Island, Ill., has an-

nounced its plans for the erection of additional factory buildings, the cost of which is expected to approach \$1,000,000.

The Chippewa Foundry & Machine Company, Eau Claire, Wis., has been reorganized with a capital of \$100,000 and will erect a new factory.

The Resilient Auto Wheels Company, Wausau, Wis., recently organized, has purchased a factory building and will install new machinery.

The Valley City Chair Company, Grand Rapids, Mich., is preparing plans for the erection of a brick factory, a temporary frame building having been built for immediate use.

The Acme Universal Joint Company, Kalamazoo, Mich., plans to begin the erection within 30 days of a new factory to be in operation Oct. 1. Lewis Rosenbaum is president.

The Lansing Fuel & Gas Company, Lansing, Mich., has plans for doubling the capacity and equipment of its plant which will involve an expenditure of \$250,000.

The Rhys-Alden Control Company, Grand Rapids, Mich., has been organized with a capital of \$10,000 by Percy F. Rice, William Alden Smith and William Alden Smith, Jr. It will manufacture and sell gear-shift and control devices and other motor vehicle accessories.

The Republic Motor Truck Company, St. Louis, Mo., will equip a machine shop and garage.

Kansas City, Mo., will install a turbine engine at its waterworks plant, to cost approximately \$100,000. H. B. Jackson is superintendent.

The H. J. Frank Foundry & Machine Company, Davenport, Iowa, will build a branch plant in Moline to consist of a foundry, machine shop and forge shop. Construction is to begin at once.

Lee Brothers, Springfield, Mo., will locate at Yellville, Ark., where they will operate a foundry and machine shops.

The Fisher Governor Company, Marshalltown, Iowa, has plans for the erection of a two-story factory. It manufactures machinery and steam pumps.

Indianapolis

INDIANAPOLIS, IND., JULY 3, 1916.

The Diamond Chain & Mfg. Company, Indianapolis, Ind., will immediately begin the erection of a complete manufacturing plant on the six-acre tract of land which it acquired four years ago, located on Kentucky Avenue. The plans contemplate a concrete structure containing four stories with 150,000 sq. ft. of floor space. The main building will be 60 x 380 ft., with two ellis 100 ft. long, making the entire frontage 700 ft. The additions will be the power plant and auxiliary buildings. The plans and construction will be done by the Westinghouse Church Kerr & Co., 37 Wall Street, New York. W. I. Ballantine is consulting engineer for the owner. The buildings and new equipment will double the present plant and capacity, which will be operated intensely until the new plant is completed, making no break in present production, which is being rapidly increased over the capacity during the past few months. L. M. Wainwright is president.

The Dice Machine Company, Anderson, Ind., is planning the installation of new machinery to double the output of its factory.

The Chesterton Iron Works, Chesterton, Ind., has been incorporated with a capital of \$25,000 to manufacture steel, iron and metal tanks, by Charles F. Remmert, Charles R. and M. Folsom.

E. C. Atkins & Co., Indianapolis, Ind., will build an addition to their plant to cost about \$75,000.

The Balls Brothers Mfg. Company has purchased a plant at Muncie, Ind., which will be used for the manufacture of corrugated paper.

The Lindley Box & Paper Company, Gas City, Ind., whose new plant will cost about \$25,000, advises that it will soon be in the market for additional motors, heating equipment and sprinklers.

The Wheeler-Schebler Carburetor Company, Indianapolis, has been incorporated with \$1,000,000 capital stock to manufacture carburetors and other automobile equipment. The directors are Frank H. Wheeler, Douglas F. Wheeler and Seymour Avery.

The Indianapolis Household Supply Company, Indianapolis, has been incorporated with \$25,000 capital stock to manufacture metal and wooden household utensils. Hardy W. Robbins, Thomas S. Catlin and Augusta P. Catlin are the directors.

The Quick Action Ignition Company, South Bend, Ind., has been incorporated with \$450,000 capital stock to manufacture electrical machinery and devices. The directors are Otto R. Beyler, Gilbert T. Dunklin and Emil E. Hawkinson.

The Rutherford Brothers Mfg. Company, Muncie, Ind., manufacturer of electric fixtures, has increased its capital stock by \$25,000, in order to enlarge its plant.

The Rockford Bit Company, Kokomo, Ind., has filed preliminary articles of dissolution.

The Pierce Governor Company, Anderson, Ind., has increased its capital stock from \$25,000 to \$100,000.

The Koons Oil Furnace Company, Anderson, Ind., has filed preliminary articles of dissolution.

The Fellwock Automobile & Mfg. Company, Evansville, Ind., has increased its capital stock from \$60,000 to \$85,000.

The Faucett-Humphrey Chair Company, Morgantown, Ind., has been incorporated with \$100,000 capital stock to manufacture furniture. The directors are Louis C. Humphrey, Joseph Faucett and Charles A. Hubbard.

The quartermaster's department, Jeffersonville, Ind., has awarded to the Studebaker Corporation, South Bend, Ind., a contract for 500 ambulances, delivery to be completed in 120 days.

The Service Motor Truck Company, Wabash, Ind., has increased its capital stock, \$100,000 by an issue of preferred certificates, the proceeds to be used in extension of the business.

The Champion Auto Equipment Company, Wabash, Ind., has bought 16 acres adjacent to its plant, which together with another ten acres, will be used partly for additional factory buildings, but mostly for dwelling-houses for its employees.

The Hayes Wheel Company, Anderson, Ind., will spend \$25,000 in making improvements to its plant. J. M. Aiken is superintendent and C. B. Hayes, Jackson, Mich., is president.

Detroit

DETROIT, MICH., JULY 3, 1916.

The Michigan Iron & Wire Works, Detroit, has been incorporated with \$10,000 capital stock to manufacture a line of ornamental metal specialties. The incorporators are C. A. L. E. and J. A. Weigel.

The General Engineering Company, Detroit, has been incorporated with a capital stock of \$200,000 by Abner Doble, C. L. Lewis and M. J. Hammers, to manufacture motor vehicles and equipment therefor.

The Detroit Edison Company, Detroit, has taken out a building permit covering the erection of a commercial heating plant to cost \$65,000. The new structure will be 58 x 125 ft., eight stories.

The Detroit Fibre Package Company, Detroit, has begun the erection of a one-story factory at Currie and Hartford avenues.

The J. R. Stone Tool & Supply Company, Detroit, has purchased the plant of the General Mfg. Company, 93-103 Meldrum Avenue, and will engage in the manufacture of metal specialties, jigs and fixtures.

The Premier Cushion Spring Company, Detroit, will provide for expansion by the increase of its capital stock from \$25,000 to \$100,000.

The Manufacturers Brass Foundry Company, Detroit, has been incorporated with \$3,000 capital stock to manufacture small brass castings. The stockholders are L. C. Veeleus, G. J. Rinke and Richard Agricola.

The Dort Motor Car Company, Flint, Mich., has purchased additional land and will erect a new manufacturing building to cost \$60,000.

The Michigan Screw Company, Lansing, Mich., has increased its capital stock from \$100,000 to \$500,000.

The Albion Bolt Company, Albion, Mich., has been incorporated with a capital stock of \$10,000 to manufacture nuts, bolts and other small automobile parts. The incorporators are Mark Merriman and M. C. Morrey, Lansing and Otto Schwacha, Albion. A factory has been acquired.

The Gile Tractor & Engine Company, Ludington, Mich., has increased its capital stock from \$100,000 to \$300,000.

The Flint Cushion Spring Company, Flint, Mich., has been organized by L. A. Young, president of the Detroit Wire Spring Company and ground for the erection of the first unit of the company's plant will be broken at once. The plans for the new plant provide for seven buildings.

Johnson Brothers, Grand Haven, Mich., boilermakers, lost their plant by fire recently with a damage of about \$140,000. A new plant is now under construction, about 50 per cent larger than the former one. Production is also going forward in temporary structures.

Milwaukee

MILWAUKEE, WIS., July 3, 1916.

The production of machine tools in the Milwaukee district in June indicates that the large volume of past months is being well maintained in spite of the absence of an abnormal demand. The business consisted of single-tool and small-lot orders, which in the aggregate furnished a volume of large dimensions. This condition is considered more than satisfactory. At the beginning of July a revival of the large-lot demand seems to be setting in, judging from inquiries; but no actual transactions have been reported.

After a lull, plant extensions and the establishment of new industries are increasing, but the metal-working trades do not lead the advance, as before, because of the absolute lack of operatives to man enlarged or new shops. Milwaukee construction figures for the first half show a gain of \$1,878,494 over the same period of 1915, or approximately 40 per cent. The Mexican situation appears to have had some effect in slightly restricting general buying, especially in retail lines; but otherwise the situation in general is considered satisfactory.

The Fitzsimmons Steel Products Company, Milwaukee, which recently completed work on its plant in the Menomonee Valley, has filed an amendment to its corporate articles to provide for an increase in the capital stock from \$40,000 to \$75,000. Robert T. Fitzsimmons is president and Ernst Prinz is secretary.

The Ozaukee Heater Company, which recently established a plant at Saukville, Wis., for the manufacture of oil burners, stoves, tank heaters, etc., has filed articles of incorporation. The capital stock is \$50,000 and the incorporators are H. J. Cary, W. Grady and Klaus de Buhr.

The Wisconsin Veneer Company, Rhinelander, Wis., has awarded contracts for a manufacturing addition and is buying a small list of wood-working machinery and mill equipment. R. C. Dayton is secretary.

The Wald Mfg. Company, Eighteenth Street and Martin Avenue, Sheboygan, Wis., will award contracts this week for the erection of a one-story brick and mill machine shop, 80 x 100 ft. Juul & Sixta, engineers, are in charge.

The Suburban Garage Company, 26 State Street, Wauwatosa, Wis., is preparing to build a second story, 55 x 130 ft., and a two-story addition, 20 x 40 ft. Some new equipment is required.

The Modine Mfg. Company, Racine, Wis., recently incorporated, will manufacture sheet-metal products and mechanical appliances. A. B. Modine is president and general manager.

The Heil Company, Twenty-sixth and Montana avenues, Milwaukee, structural fabricator, etc., has engaged Klug & Smith, consulting engineers, Mack Block, Milwaukee, to prepare plans for a shop building, 50 x 220 ft., one-story, of reinforced concrete, brick and steel. J. P. Heil is general manager.

The Jamieson Brothers Company, Poynette, Wis., are building a garage, machine shop and warehouse on the Norton machine shop site.

Peter Pirsch & Co., 109 Market Street, Kenosha, Wis., manufacturers of fire apparatus, have engaged White & White, architects, Public Service Building, Milwaukee, to prepare plans for a one-story factory addition, 100 x 200 ft., to contain the blacksmith shop, toolroom, paintshop, stockroom, etc.

Carl Barkhausen, architect, 408 Iron Block, Milwaukee, is preparing plans for a foundry, to be erected at Sixty-third Avenue and Burnham Street, West Allis, of hollow tile and brick, 30 x 50 ft., and to cost about \$5,000. The name of the owners is withheld.

A commercial machine shop has been opened at Burlington, Wis., by Chester Bradford and John Nelson, Racine, Wis., who are remodeling the Wagner machine shop on Pine Street.

The Michigan Electro-Chemical Company, Menominee, Mich., has been incorporated under the laws of Michigan by capitalists of Marinette, Wis., and Menominee to establish a plant and laboratory. The capital stock is \$150,000. Officers have been elected as follows: President, Edward Daniell, general manager, Menominee & Marinette Light & Traction Company; vice-president, R. F. Goodman, Marinette; secretary, A. R. White, Marinette; treasurer, C. W. Gram, Menominee.

John Steckart, Sr., DePere, Wis., is erecting a garage and repairshop, 40 x 60 ft.

Bids will be taken in a few days for the erection of the new drop forge plant and machine shop of the John Ohenberger Forge Company, Milwaukee, at Sixty-third Avenue and Lapham Street, West Allis. The engineers are Klug & Smith, Mack Block, Milwaukee.

The Four Wheel Drive Automobile Company, Clintonville, Wis., which is filling large orders from the war department, as well as European governments, is rushing work on the latest machine shop addition, 100 x 200 ft., and is outlining preliminary plans for a new foundry to be added in the fall.

Citizens of Waupaca, Wis., have subscribed for nearly all of the capital stock required by the Jersild Fire Escape Company, Neenah, Wis., to insure its location there. It is likely that one of the idle factory buildings will be leased as a plant.

J. H. Newbury, Warsaw, N. C., and associates of Akron, Ohio, have practically closed a deal with local capital at Spooner, Wis., to establish a rubber and tire factory, the initial unit of which will be 60 x 100 ft. Cheap hydroelectric power available at Spooner is the main factor.

The O-U-Lite Company, Racine, Wis., has been incorporated with a capital stock of \$12,000 by F. C. Christensen, T. W. Fuller and J. C. Christensen to manufacture electrical generating systems for automobiles, farms, etc.

The Pan-American Rubber Company, Milwaukee, has been incorporated with a capital stock of \$200,000 to manufacture a cellular pneumatic inner tire. It has established a factory in the Kopmeier Building, Third and Prairie streets, and is already employing 50 operatives. F. J. Ramier is president and general manager.

Birmingham

BIRMINGHAM, ALA., July 3, 1916.

The continuous changing from steam to electricity in mine and mill in Alabama is calling for a variety of electrical appliances. It is one of the leading features of the machinery trade. The quicker delivery on machine tools is gratifying. Business continued good up to the holidays.

The Alabama Iron Works, the Ollinger & Bruce Dry Docks and the Gulf Dry Docks companies, Mobile, have consolidated. D. R. Dunlap, of the Alabama Iron Works, will be president. The capital will be \$500,000. It is planned to build a dry-dock and install steel plate-working shop for constructing steel vessels, floating docks, wharves, sawmills, wood-working plants, etc. Ample capital and works already in successful operation are embraced.

The Macon Veneer Company, Macon, Ga., has been incorporated by James T. Wright, George W. Hubbell and others with a capital stock of \$80,000 to manufacture wooden boxes, baskets, barrels, etc.

Cleveland

CLEVELAND, OHIO, JULY 3, 1916.

An improved demand is noted for large machine tools, some single tool inquiry having come out for planing machines, boring mills and radial drilling machines in large sizes. Inquiry is absent for round lots of standard machines but dealers report a fair volume of orders for one or two tools. Deliveries on some lines of standard machines have improved somewhat. The labor situation is slightly easier owing to the fact that some automobile plants in the Central West are not crowding production as they have been the past few months. It is understood that the large export orders for motor trucks for war purposes have about all been filled. Skilled workmen are still scarce. The demand for twist drills continues quite heavy.

The Kuhlman Car Company, Cleveland, is enlarging its plant by the erection of a steel frame shop with brick walls, 80 x 440 ft. to be used for the construction of steel car bodies for street railway cars. The power plant is being enlarged by the installation of two 315 hp. Sterling boilers.

The Babbitt Spring Oiler Company, Cleveland, has been incorporated with a capital stock of \$100,000 by G. G. Babbitt, A. R. Edgerton, N. S. Bunker, George H. Pitts and H. C. Morris.

The Firestone Tire & Rubber Company, Akron, Ohio, has had plans prepared for a new power plant, understood to be of about 12,000 kw. capacity, or about doubling its present plant.

The Urschel Drop Forge Company, Bowling Green, Ohio, recently incorporated, has acquired a two-acre site upon which it will erect a plant including a main building 45 x 125 ft., another 30 x 60 ft. and several smaller buildings. Some electrically driven machinery will be installed.

The Hinderer Brothers Company, Canton, Ohio, will erect a two-story brick foundry and pattern shop. It will specialize in the construction of steam and hot water heating apparatus.

The Ashtabula Leather Products Company, Ashtabula, Ohio, has been incorporated with a capital stock of \$50,000 to manufacture leather specialties and will erect two two-story buildings, 40 x 75 ft. and 20 x 50 ft. respectively.

W. H. Fetters, Plymouth, Ohio, will establish a machine shop in Bellevue, Ohio, in the plant of the Klein Iron & Steel Company.

The Westcott Motor Company is establishing a plant in Springfield, Ohio, in the factory of the Buckeye Implement Company. It is expected that some machine tool equipment will be required.

Cincinnati

CINCINNATI, OHIO, July 3, 1916.

Auto-truck manufacturers in the Central West are very busy and are quietly buying machine tools, but not in any large numbers. It is freely predicted that this branch of the manufacturing trade has an extended period of prosperity before it. The railroads are only buying sparingly, and an official is credited with the statement that presents costs of all kinds of shop equipment are holding back purchases.

The Cincinnati Planer Company, Oakley-Cincinnati, has let contract for an addition to its plant, 55 x 150 ft., one story, of regular mill construction, to be used for pattern storage purposes. Annealing furnaces will be installed in one part of the building.

The Barrett Mfg. Company, Cincinnati, has let contract for a two-story addition to its plant in West End that will be 75 x 100 ft., of mill construction, to be used exclusively for storage purposes.

The National Fender & Auto Parts Company, Cincinnati, has been incorporated with \$50,000 capital stock by J. J. Shevlin and others. Nothing is yet known as to manufacturing plans.

The Dayton Research Laboratories Company, Dayton, Ohio, whose incorporation was recently noted, will engage in research work in electrical, mechanical and chemical lines. E. A. Deeds is one of the principal incorporators.

The Steel Products Engineering Company, Springfield, Ohio, recently incorporated, has fitted up a machine shop on Dakota Avenue.

The Miller Improved Gas Engine Company, Springfield, Ohio, has let contract for an addition to its plant that will be 62 x 120 ft., one story, of brick and concrete construction.

The Concrete Steel Construction Company, Springfield, Ohio, has commenced work on the new plant of the Blackwood Steel Castings Company.

The J. P. Gordon Company, Fourth and Naghten streets, Columbus, Ohio, will fit up a plant for the manufacture of automobile tires.

The Urbana Tool & Die Company, Urbana, Ohio, is reported to have recently received a large order for dies from the Ford Motor Company and is adding to its mechanical equipment.

The Cullen & Vaughn Company, Hamilton, Ohio, factory building contractor, has opened an office at 8 East Broad Street, Columbus, Ohio, and it is currently reported that its headquarters will be removed to that city.

St. Louis

ST. LOUIS, Mo., July 3, 1916.

The demand for machine tools continues quite active. Users of equipment, still aware of the comparative difficulty of getting orders filled, are continuing their policy of buying as they can get quick hold of desirable machinery. No second-hand equipment is appearing, and the supplies of such machinery are at the minimum.

The Mineral Refining & Chemical Company, St. Louis, Mo., has been organized with a capital of \$2,000,000 by Joseph Marimon, Havana, Cuba; M. J. Mandulay of Havana, and R. Bonastre of New York, with headquarters at the Planters Hotel, St. Louis. Contracts are being let for the first manufacturing unit with a daily capacity of 50 tons.

The Prestolite Company, 27th and Locust streets, St. Louis, Mo., will equip a service station and machine shop for repair work.

A company with \$50,000 capital is being formed in St. Louis by Jacob Engel, 4737 Washington Boulevard and others, and will shortly begin installing equipment for the manufacture of a patented attachment for printing presses.

The Twentieth Century Mfg. Company, St. Louis, has been incorporated with a capital stock of \$13,000 by Edward M. Lynch, Bernard P. Bogy and Humphrey A. Buck to manufacture automobile parts.

The Newell Motor Car Company, St. Louis, Mo., has been

incorporated with a capital stock of \$100,000 by James E. Newell, M. Frank and E. B. Foote to operate a machine and repair shop, etc.

The Shaw Marble & Tile Company, St. Louis, Mo., has been incorporated with a capital stock of \$25,000 by James Shaw, Louis M. Brohammer, Joseph B. Gander, George W. Aurin and Harry J. Smith to operate a quarry and manufacture stone.

The Commercial Auto Body Company, St. Louis, Mo., has been incorporated with a capital stock of \$50,000 by H. F. and M. E. Cartwright and others to manufacture automobile bodies and will add equipment to a wood-working plant already in operation.

The Aniser Mfg. Company, St. Joseph, Mo., has been incorporated with a capital stock of \$18,000 by J. A. Aniser, John D. Richardson and J. E. Dolman to manufacture machinery and tools.

St. Joseph, Mo., will expend about \$85,000 on additional equipment for its electric light plant, which will be reconstructed.

The Helena Compress Company, Helena, Ark., has been incorporated with a capital stock of \$50,000 by W. N. Straub, Lee Pendergrass and S. H. Swenson and will equip a cotton compress.

The Independent Gin Company, Jonesboro, Ark., has been incorporated with a capital stock of \$18,000 by William Craddock, J. L. Magers and others.

The Farmers Gin Company, Little Rock, Ark., has been incorporated with a capital stock of \$15,000 by W. N. and A. W. Godbey and A. G. Kahn.

The Marvell Electric Light & Power Company, Marmaduke, Ark., has been incorporated with a capital stock of \$15,000 by A. S. and J. R. Bertig and B. G. Brinkmann and will equip a plant.

The Southern Lumber Company, Warren, Ark., will equip an additional sawmill unit of 125,000 ft. daily capacity.

A plant for the manufacture of spokes and other wheel-stock will be equipped at Montrose, Ark., by the Archibald Wheel Company, Lawrence, Mass.

The United Brick & Tile Company, Tulsa, Okla., has been incorporated with a capital stock of \$100,000 by John D. Richards, W. D. Abbott and B. A. Peek and will establish a brick plant.

The Imperial Washing Machine Company, Sand Springs, Okla., has been incorporated with a capital stock of \$60,000 by W. E. Page, G. W. Moore and Ed Mondell, all of Tulsa.

The Hartsaw Tank Protector Company, Tulsa, Okla., has been incorporated with a capital stock of \$100,000 by D. W. Hartsaw, Sam Arrendale and R. W. Conger of Bristow, Okla., and E. M. Barber of Drumright, Okla.

The Chief Oklahoma Garage Company, Shawnee, Okla., has been incorporated with a capital stock of \$15,000 by J. T. Lucas, James H. Turner and A. O. Turner.

Joseph Arely, Enid, Okla., will equip a wood-working plant for the manufacture of automobile bodies. He will install an isolated electric lighting plant.

Mound Bayou, Miss., will install an oil engine, pump and other waterworks equipment for which it will receive bids until July 13. S. H. Harris is city clerk.

E. T. Alcus & Co., New Orleans, La., have bought the Tylertown Box Mfg. Company's plant at Tylertown, Miss., and will double its capacity.

Lake Charles, La., will construct large wharf and warehouse facilities as part of a dock system on which will be installed mechanical freight-handling equipment.

Lockport, La., will equip a waterworks pumping station. W. R. Pennington is chairman in charge.

The Sewerage and Water Board, New Orleans, La., F. S. Shields, secretary, will receive bids on one 75-hp. motor with accessories, and some electric equipment.

Texas

AUSTIN, TEX., JULY 1, 1916.

Industrial conditions in Texas continue remarkably good. The demand for machinery that enters into manufacturing plants is greater than for a long time. Crop prospects are excellent, good rains having fallen in most parts of the State the last few days.

The Main Street Garage, Houston, will build a garage and repair shop. George F. Howard is manager.

The Texas Plating & Wire Works Company, Beaumont, will install equipment for plating and manufacturing wire devices. John Dollinger is in charge.

The Petroleum Refining Company, Houston, recently in-

corporated with a capital stock of \$1,000,000 under the laws of Delaware, has purchased a site six miles south of Harrisburg on the Houston ship channel, where it will build an oil refinery. J. S. Cullinan is a stockholder.

The Farmers' Union Gin Company, Geronimo, has increased its capital stock from \$10,000 to \$16,000 and will enlarge its cotton gin.

E. E. Townsend, Alpine, will install an irrigation pumping plant on Cayonosa Creek to irrigate 1082 acres of land.

The Whyman Land & Development Company is constructing an irrigation system near Maricopa, Ariz. A pump and 140-hp. engine are specified.

The Texas Utilities Company, Plainview, will install a 500-hp. oil-burning engine in its central electric power station.

The Republic Box Company, Dallas, has leased land upon which it will build a factory for the manufacturing of wire-bound boxes. R. O. Harris is vice-president and general manager.

The Dallas Union Terminal Company has been authorized by the State Railroad Commission to issue an additional \$807,000 worth of bonds, the proceeds to be used in completing the new union station at Dallas. The sum will bring the bond issue up to \$5,000,000.

A. H. Dunkerley is erecting a building at Ennis which will be occupied by the National Garage as a garage and machine shop.

F. D. Thomas, Dallas, and associates, have purchased 190 acres at Hone, Tex., upon which they will build a plant for manufacturing guncotton, absorbent cotton and surgical bandages, at a cost of about \$250,000.

It is announced by Frank Andrews of Houston, chairman of the Gulf Coast Lines which include the New Orleans, Texas & Mexico, the Beaumont, Sour Lake & Western, and the St. Louis, Brownsville & Mexico, that the general shops of these roads will be built at Kingsville.

The Pacific Northwest

SEATTLE, JUNE 27, 1916.

A policy of gradual curtailment in the lumber industry is being put into practice throughout the entire Northwest. After five months of good business with wages advancing and mills speeded up, a marked lull in demand has set in and prices have been lowered in an effort to stimulate the market. While the curtailment move is not organized, it is being put in practice in all the larger mills.

Reports from Oregon indicate that shipbuilders in that section are experiencing an unparalleled period of prosperity. Orders now on hand are sufficient to keep the larger plants busy for five years, and every plant is running day and night. The industry has become almost independent in that section, as most of the yards operate their own lumber mills, thus obviating the difficulty of delivery.

A movement is on foot to establish a smelting plant for the electrolytic reduction of zinc ore in Spokane, Wash., at a cost of \$500,000. Jap P. Graves, J. P. McGoldrick, George Turner, J. D. Sherwood and Walter J. Nicholls, all capitalists of Spokane, are back of the enterprise. J. O. Pateneaudie, inventor of a refining process, is also a promoter.

The Boise-Payette Lumber Company, Boise, Idaho, will begin work within 30 days on the construction of a saw-mill at Emmett, Idaho, to cost \$500,000. The plant will cover an 80-acre site and will be electrically operated, with a daily capacity of 200,000 ft. The company will also expend about \$100,000 in additions and extensions to its mill near Boise. C. A. Barton is vice-president and general manager.

The Pacific Foundry & Machinery Company, Seattle, has been incorporated for \$500,000 by J. L. MacDonald, H. S. Hendrickson and Frank S. Paul.

The Astoria Machine Company's plant in Astoria, Ore., has been purchased by John Fox, president of the Seattle-Astoria Iron Works, Seattle, and C. E. Mack of Portland. The new owners will install \$25,000 worth of new machinery, and will equip the plant for marine, logging camp and mill work.

The Pacific Boiler Company, 549 Dock Street, Tacoma, Wash., has commissioned Bullard & Hill, architects, Tacoma, to prepare plans for another addition to its recently completed plant. It will be 50 x 80 ft. The plant is at present running three 8-hr. shifts. O. T. Nelson and H. H. Christman have charge of the company.

The American Shipbuilding Company, Spokane, Wash., has finally determined upon Warrenton, Ore., as the site for its proposed shipbuilding plant. A site 10 miles from the ocean has been donated by the city, and construction

work is to be rushed, under the personal charge of W. F. Lafrenz, chief engineer. Harry B. Spear is president.

The Olympic Metals Company, Edmonds, Wash., has recently leased a building which will be remodeled as a smelting plant.

The Williams Blow Pipe Company, Tacoma, Wash., will construct a new plant, 40 x 75 ft., in the tideflats manufacturing district, to be completed this year. The proposed building will provide room for the installation of new machinery and the enlargement of operations made necessary by growing business. P. F. Finnegan and Dayton M. Maltby are the owners.

The Garford Motor Truck Company, Lima, Ohio, will establish a branch factory in Seattle. A new structure will be built and will be in charge of A. W. McKinzie. E. A. Williams, Jr., president and general manager, recently visited Seattle.

The Foundry of the Huffschmidt-Dugan Iron Works, Bend, Ore., was seriously damaged by a recent fire. The foundry building was entirely destroyed and the pattern shop damaged. New structures will be built and equipped with new machinery.

The Grays Harbor Lumber Company, Aberdeen, Wash., plans the addition of a lathe factory in connection with its sawmill.

The Kamiah Asbestos Mfg. Co., Grangeville, Idaho, has recently been organized, and plans the construction of a factory to be in operation by fall.

The J. A. McEacher Company, Astoria, Ore., which recently established a shipbuilding yard in that city, has been reorganized by the incorporation of the McEacher-Standifer-Clarkson Ship Company, which has a capital stock of \$500,000. The present plant is to be doubled, and a large drydock built. The company also announces that its future plans include the establishment of a yard constructing steel vessels.

The consolidation of the Puget Sound Mills & Timber Company, of which Michael Earles, Seattle, is president, and the Charles Nelson Company of San Francisco, operating a fleet of steam lumber carriers, has been effected, bringing under one control properties valued at more than \$8,000,000. The Puget Sound Mills Company owns standing timber in Clallam County estimated at 400,000,000 ft., and a sawmill plant at Port Angeles. The merger will assist both companies in the way of market extensions.

Canada

TORONTO, JUNE 30, 1916.

Satisfactory progress was made at conference recently held between Thomas White, Minister of Finance, and the committee of the Canadian Bankers' Association regarding an extension of the credit to the Imperial Government to facilitate the purchases of war supplies in Canada. No announcement is being made as to the extent of the new credit. As a result of the previous conference a credit of \$76,000,000 was established with the result that \$100,000,000 additional orders were obtained. At the present time the Imperial Munitions Board is disbursing in Canada from \$1,000,000 to \$1,500,000 per day, which is keeping busy over 300 plants. In addition, Mr. White brought to the attention of the association the desirability of Canada being financially prepared for a greatly increased export trade with Russia and the other allies after the war, and it is understood that attention will be given to the question of establishing, if necessary, a financial agency or agencies to deal with foreign credits.

It was recently reported by an official of the Canadian Car & Foundry Company of Montreal that in June nearly \$1,500,000 worth of the original 5,000,000 shrapnel shells ordered by the Russian Government will have been shipped from American ports. The value of the shells which will have been shipped by the end of June was placed at nearly \$12,000,000. All the component parts are now coming forward rapidly and it is anticipated that by the first of November the entire \$85,000,000 contract will have been completed. Apart from the Russian business the company has \$13,000,000 in orders on its books. Two-thirds of this business is made up of domestic orders, which include contracts for shell parts from the British Government. The balance is for railroad equipment, 70 per cent of which calls for cars for shipment to Europe. The Canadian demand for equipment continues very light and it is believed that roads in Canada will withhold their orders as long as possible, to avoid paying the increased prices now prevailing for all raw material. In this connection it may be noted that the price of an equipment has advanced from 50 to 60 per cent.

Shipments made last month by the Nova Scotia Steel &

Coal Company, New Glasgow, N. S., have created a new record, and several new daily records were also made during the month. The shipments include a large quantity of 8.8-in. and 9.2-in. shells. Notwithstanding the large output, the unfilled orders on hand on June 15 were greater than the unfilled orders on hand May 15. The work of building steamers at New Glasgow, in which the steel company is interested, has begun. The first steamer will be of 2,000 tons register.

Canada's trade for May reached a figure more than double that of the corresponding month of 1915. The total for last month was \$176,837,000, as compared with \$86,023,000 for May, 1915. For the first two months of the fiscal year, April and May, the aggregate was \$284,555,000, as against \$145,244,000 a year ago. The increase is general all round and is taken as reflecting generally prosperous conditions.

The Roelofson Machine & Tool Company, Ltd., Galt, Ont., will commence the erection of a plant 105 x 185 ft. on Beverley Street, for the manufacture of machinery, tools, etc. E. C. Roelofson, Toronto, is president; A. C. Roelofson, works manager; and E. B. Roelofson, vice-president.

The Packard Electric Company, St. Catharines, Ont., has commenced the erection of an addition 50 x 145 ft., two stories.

The Standard Steel Construction Company, Port Robinson, Ont., has leased the building recently occupied by the Dominion Canners and will install new equipment and have facilities for 200 additional hands.

The Canadian Gasoline Corporation, which is in course of organization in Canada with a capital stock of \$3,000,000, has acquired the Canadian patents for the Greenstreet process of gasoline manufacture. It will be operated as a subsidiary of the Gasoline Corporation of the United States. The syndicate financing the Canadian proposition is headed by H. T. Bush, president of the Standard Ideal Company of Port Hope, Ont.; Donald Mann and Daniel Currie, president of the Canadian Car & Foundry Company are represented in the syndicate.

Work will be commenced at an early date on the building of a shipbuilding plant at the Songhees Reserve, Victoria, B. C., for the Cameron-Genoa Mills Shipbuilders, Ltd. J. H. Price, manager of the St. Helens Shipbuilding Company, St. Helens, Ore., is the general superintendent and architect who will supervise the ships to be constructed at the new yards.

The Hendry Crossman Electric Company, Ltd., 80 Dufferin Street East, Vancouver, B. C., is in the market for a 12 or 15 kw., 110-volt direct-current generator.

The Chevrolet Motor Company, Oshawa, is building a factory at a cost of \$40,000.

The William Davies Company, 521 Front Street East, Toronto, has had plans prepared by Heuschle & McLaren, 431 South Dearborn Street, Chicago, Ill., for a brick and concrete cold-storage and ice plant to cost \$50,000.

The Canadian Cartridge Company, Sherman Avenue North, Hamilton, Ont., will build an addition to its plant at a cost of \$20,000.

The Department of Public Works, Ottawa, Ont., proposes to establish an electric generating plant at Peace River, Alberta, and has had plans prepared by W. D. Cromarty, University of Alberta, Edmonton, Alberta. R. S. Desrochers is secretary of works department.

The foundry at Beaucheville, Que., owned by Marcoux & Poirier was destroyed by fire with a loss of \$12,000.

The Acadia Coal Company of Stellarton, N. S., will install a 3000-kw. steam turbine at its plant. F. Mosebaert, Stellarton, is chief engineer.

The Watrous Electric Light Company, Watrous, Sask., will install a new gas producer plant.

The Chapman Engine & Mfg. Company, Ltd., Dundas, Ont., has been incorporated with a capital stock of \$250,000, by Stephen H. Chapman, care of the Ontario Wind Engine & Pump Company, Liberty Street, Toronto, George W. Williams and others of Dundas, Ont.; Edward Fairbairn, Buffalo, N. Y., to manufacture engines, electric motors, etc.

The Canadian Collapsible Tube Company, Ltd., Toronto, has been incorporated with a capital stock of \$100,000 by Richmond W. Hart, 1126 Traders Bank Building; Kenneth D. McKenzie, William W. Perry, Scarborough Junction and others, to manufacture collapsible metallic tubes.

The fire, light and power committee of Winnipeg, Man., will purchase two gasoline pumps instead of one, as formerly reported.

Wilson Brothers, Vancouver, B. C., an American company with timber holdings on Vancouver Island, is making arrangements for the erection of a lumber mill there to cost about \$4,000,000.

Government Purchases

WASHINGTON, D. C., July 3, 1916.

Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, July 18, schedule 9821, for one hydraulic joggling press for Brooklyn; schedule 9822, for two air compressors and one pipe-cutting and threading machine, all for Boston; until July 25, schedule 9824, for four main circulating pumps for Mare Island and Norfolk; schedule 9825, for miscellaneous lathe chucks for Mare Island and Brooklyn; schedule 9828, for one combined foot and power lathe for Puget Sound; until date not set, schedule 9859, for one fire pump for Brooklyn; schedule 9860, for one centrifugal pump for Philadelphia; and schedule 9861, for one complete hydraulic accumulator for Brooklyn.

The general purchasing officer of the Panama Canal, Washington, will receive sealed proposals until 10:30 a. m., July 20, under Panama circular 1058, for a pipe-threading and cutting-off machine; under requisition 3072-F for furnishing one second-hand 12 to 18-in. x 10 to 16-ft. engine lathe, preferably motor-driven. Details of specification can be had from Major E. I. Brown, general purchasing officer, corps of engineers, Army Department.

Bids were received at the Bureau of Supplies and Accounts, Navy Department, Washington, June 27, for supplies for the naval service, as follows:

Schedule 9740, Ordnance, for Newport

Class 61—Five hand and power feed milling machines with three vertical attachments—Bid 19, \$2,945; 64, \$2,395; 73, \$2,672.50; 92, \$2,334; 142, \$2,675; 217, \$2,672.50.

Class 62—One tool grinder—Bid 19, \$611.50 and \$862.50; 123, \$2,604; 143, \$300.

Class 63—One drill grinder—Bid 107, \$194; 123, \$170 and \$82; 142, \$203, \$109 and \$107; 165, \$180.

Class 64—12 toolmakers' engine lathes—Bid 67, \$1,242.25; 123, \$1,350; 144, \$1,250; 164, \$1,336 and \$1,104.

Class 65—Eight bench lathes—Bid 64, \$678; 92, \$742.50; 123, \$349.25 and \$600; 142, \$2,960, total, and \$4,784, total; 164, \$851.75.

Class 66—One universal cutter and tool grinder—Bid 19, \$1,053.50; 77, \$355; 142, \$395, \$450, \$607 and \$275; 144, \$670; 153, \$612.

Class 67—One sliding-head drill—Bid 85, \$295; 123, \$440; 142, \$242 and \$245; 144, \$221; 165, \$236.

Class 68—One machine for filing, sawing and lapping—Bid 123, \$278; 154, \$100; 202, \$100.

Class 69—One surface grinding machine—Bid 19, \$433.75; 123, \$430.

Class 70—Two horizontal tapping machines—Bid 19, \$611.75; 113, \$1,625; 123, \$1,625; 142, \$756 and \$300.

Class 71—One hand screw press—Bid 142, \$330; 183, \$415.

Class 72—Six polishing and finishing machines—Bid 19, \$132; 142, \$100.

Class 73—One semi-automatic screw slotter—Bid 143, \$345.

Class 74—One polishing or buffing machine—Bid 142, \$190; 257, \$300 and \$385.

Class 75—Two bench drills—Bid 113, \$220.50; 123, \$220.50; 142, \$217.

Class 76—One vertical riveting machine—Bid 123, \$189; 142, \$144, \$175 and \$202; 196, \$215; 205, \$195; 254, \$319.

Class 77—One inclinable power press—Bid 142, \$310, \$318 and \$298; 165, \$370; 174, \$265; 183, \$265.

Class 78—One saw sharpener. Bid 122, \$222 and \$180; 254, \$297.

Class 79—Six shaft-straightening presses—Bid 79, \$120; 123, \$387.55; 142, \$447.

Class 80—One portable crane and hoist—Bid 37, \$83.88; 67, \$93.25; 70, \$74.37; 87, \$115; 122, \$74.90; 123, \$57.75; 142, \$61 and \$68; 217, \$89.99; 254, \$89.50 and \$67.40.

Class 81—Two sensitive assembly drills—Bid 85, \$135; 142, \$380, \$480 and \$370.

Class 82—Three bench sensitive drill presses—Bid 37, \$161.40; 64, \$145; 112, \$187; 113, \$225; 123, \$225; 142, \$432, \$360 and \$489.

Class 83—One oil extractor—Bid 123, \$672 and \$625; 142, \$555, \$657 and \$707; 155, informal; 254, \$613.

Class 84—Six engine lathes—Bid 67, \$1,074.25; 123, \$1,750 and \$2,250; 144, \$1,895; 165, \$1,465.

Class 85—Two sensitive drill presses—Bid 112, \$207; 123, \$456 and \$346; 142, \$236, \$235 and \$165; 165, \$156; 241, \$335.20.

Class 86—Two full automatics—Bid 143, \$3,490.

Class 87—Two hand screw machines—Bid 19, \$433; 123, \$515 and \$371; 221, \$552.

Class 88—Two hand screw machines—Bid 19, \$504; 123, \$515 and \$410; 221, \$598.

Class 89—Two turret lathes—Bid 19, \$1,296; 23, \$1,430; 72, \$1,308; 123, \$942; 165, \$1,475 and \$1,550; 221, \$1,490.

Class 90—One heavy plain milling machine—Bid 19, \$2,754.50 and \$2,254.50; 144, \$3,200.

Class 91—Four plain milling machines—Bid 19, \$1,125; 153, \$1,562.

Class 92—Four automatic screw machines—Bid 19, \$1,390; 143, \$6,900.

Class 93—Two spline milling machines—Bid 164, \$1,010.

Class 94—Two profiling machines—Bid 112, \$990; 123, \$1,000; 142, \$806; 164, \$1,055.

Class 95—Two universal grinding machines—Bid 19, \$865; 64, \$749; 123, \$1,250; 153, \$914.

Class 96—One hole chuck grinder—Bid 30, \$965 and \$1,065; 165, \$1,225.

Class 97—Two sensitive drill presses—Bid 112, \$327; 123, \$495 and \$405; 142, \$429 and \$430; 165, \$446; 241, \$592.40.

Class 98—One universal milling machine—Bid 19, \$1,462.50.

Class 99—One universal milling machine—Bid 19, \$1,776.

Class 100—Two turret machines—Bid 143, \$3,670; 242, \$3,637 and \$1,781.10.

Class 101—Four turret lathes. Bid 99, \$1,980.

Class 102—Four flat turret lathes—Bid 99, \$1,900; 123, \$1,995; 165, \$2,050, part, and \$2,190, part; 221, \$2,420 and \$2,838.

Class 103—Two turret drills. Bid 123, \$840; 168, \$415.

Schedule 9782, Steam Engineering

Class 223, Norfolk—Sixteen valve reseating machines—Bid 24, \$2,160; 80, \$2,160; 84, \$2,160; 107, \$2,360; 109, \$2,160; 114, \$2,160; 119, \$2,160; 122, \$2,160; 126, \$2,160; 179, \$2,160; 182, \$2,160; 251, \$2,160; 254, \$2,160.

Schedule 9787, Construction and Repair

Class 261, Brooklyn—Three motor-driven pipe threading machines—Bid 101, \$373, part; 107, \$835 and \$1,528.75; 109, \$2,318; 142, \$3,021; 254, \$3,388.

Schedule 9788, Construction and Repair

Class 262, Boston—One chain-testing machine—Bid 59, informal; 151, \$43,500; 252, \$50,000.

Schedule 9806, Construction and Repair

Class 263, Brooklyn—Two drop hammers—Bid 16, \$3,581; 67, \$2,116.80; 123, \$1,700; 142, \$2,200; 208, \$2,250; 240, \$1,975.

Class 264—Two trimming presses for drop forgings—Bid 67, \$1,862; 189, \$1,875; 249, \$1,832.

Schedule 9807, Construction and Repair

Class 265—Two buffing lathes—Bid 107, \$236.50 and \$319; 142, \$175 and \$190.

Class 266—One drill press—Bid 107, \$423 and \$382; 142, \$345 and \$291; 144, \$435.

Class 267—One spindle drill—Bid 107, \$1,006.75 and \$555; 112, \$537; 142, \$480; 144, \$1,095.10.

Class 268—One sensitive drill—Bid 35, \$116; 107, \$115; 142, \$110 and \$142.50; 144, \$328.25.

Class 269—Two single stand hammers—Bid 16, \$1,566 and \$1,272; 123, \$1,060 and \$1,160; 142, \$1,350; 144, \$975.

The names of bidders and the numbers under which they are designated in the above list are as follows:

Bid 16, Buffalo Foundry & Machine Company; 19, Brown & Sharpe Mfg. Company; 23, Bardons & Oliver; 24, F. S. Banks & Co.; 30, Bryant Chucking Grinder Company; 35, James Clarke, Jr., Electric Company; 37, Carroll Electric Company; 59, A. H. Emery; 64, the Fairbanks Company; 67, Federal Sales & Service Company; 70, Frank Ferguson; 72, the Walter H. Foster Company; 73, Fox Machine Company; 77, Greenfield Machine Company; 79, P. A. Geler Company; 80, Richard W. Geldart; 84, Richard H. Grey; 85, Hoefer Mfg. Company; 87, Charles H. Hughes; 92, Hill, Clarke & Co.; 99, Jones & Lamson Machine Company; 101, Jarecki Mfg. Company; 107, Kemp Machinery Company; 109, Knickerbocker Supply Company; 112, Leland-Gifford Company; 113, Langelier Mfg. Company; 114, Leavitt Machine Company; 119, McArdle & Cooney; 122, Manhattan Supply Company; 123, Manning, Maxwell & Moore, Inc.; 126, Montgomery & Co.; 142, D. Nast Machinery Company; 143, National-Acme Mfg. Company; 144, Niles-Bement-Pond Company; 151, Tinius Olson Testing Machine Company; 153, the Oesterlein Machine Company; 154, Oliver Instrument Company; 155, Oil & Waste Saving Machine Company; 164, Pratt & Whitney Company; 165, Prentiss Tool & Supply Company; 168, A. D. Quint; 174, Rockford Iron Works; 179, Richard B. Sherman; 182, Thomas Somerville Company; 183, Standard Machinery Company; 189, D. H. Stoll Company, Inc.; 196, F. B. Shuster Company; 202, Taylor Machinery Company; 205, Williams, White & Co.; 208, United Engineering & Foundry Company; 217, Ward & Co.; 221, Warner & Swasey Company; 240, E. W. Bliss Company; 241, Brownell Machinery Company; 242, Cleveland Automatic Machine Company; 249, Niagara Machine & Tool Works; 251, James D. Rawles Company; 252, Riehle Brothers Testing Machine Company; 254, Universal Trading Company; 257, Gardner Machine Company.

American Society for Testing Materials

(Continued from page 26)

as a contribution of general interest rather than as an additional piece of literature likely to interest actively those closely engaged in heat-treatment work, but it evoked considerable discussion. Dr. Henry M. Howe, in a written review of the paper, questioned that a drawing temperature as high as 635 deg. C. was needed.

Our present evidence, he said, indicates that the chemical transformation from the high to the low-temperature state, which is obstructed by the rapid cooling in quenching, becomes complete on drawing at about 400 deg. If, for instance, he argued, the quenching stresses become harmless on drawing at say 500 deg., then 500 deg. is the proper drawing temperature. Should this leave the strength too great and the ductility too small, it would seem better, he suggested, to get the needed weakening and ductilizing through smaller carbon content than through higher drawing temperature. The paper was abstracted at length in last week's issue.

R. P. Devries, assistant physicist, Bureau of Standards, Washington, D. C., noted that the ratio of elastic limit to ultimate strength is greater for the water-quenched than for the oil-quenched axles. In work done on repeated stress testing of heat-treated steel, he had found the ratio apparently a good criterion of endurance. The differences encountered in the mechanical properties of the axles quenched in water or oil appeared to him to be small, due doubtless to the high drawing temperatures employed. The microstructures shown by the author seem to show, he added, that the heat treatment as a whole was little more than a grain-refining process with a slight difference in favor of the water-quenched axles.

QUENCHING HIGH-CARBON ARTICLES IN OIL

Dr. J. S. Unger, manager of the Central Research Bureau of the Carnegie Steel Company, Pittsburgh, presented a written discussion. If segregation is to be made responsible for cracking on quenching, he wanted to know, how it is possible to water-quench a piece of case-hardened steel or of deeply cemented steel without cracking. We have, he said, produced artificial segregation of the carbon many times greater than tabulated by the author, yet case hardened pieces do not break. He added that as the carbon in steel increases it becomes more sensitive to rapid thermal changes. For example, an axle containing 0.55 per cent carbon will stand more thermal abuse than one containing 1 per cent carbon, and it is practically impossible to water-quench a 10-in. hollow axle containing 1 per cent carbon without breaking it into several pieces. He said that small articles of high carbon steel, such as for tools, valves, saws, etc., which must be hard, are quenched in oil not because of the segregation but because rapid cooling in water will induce strains that will rupture the material, even though homogeneous. Section and size of object have a great influence on the cracking of steel when quenched in water. Crops from rails at the hot saws when thrown into water invariably crack between the head and web, but this does not happen if the piece is quenched in oil. No large forgings of the grade of steel discussed by the author are, he added, ever quenched in water.

To make a comparison, he held that the axles should have been rolled from the same ingot and as nearly as possible from the same location in the ingot. Since this is impossible, however he suggested that the axle should be cut transversely at the center and each half treated at the same time and in the same furnace. He stated that vegetable, animal and mineral oils have shown differences in hardness of about 15 per cent for the same steel quenched in them, all other conditions the same.

Dr. Unger said that a water-quenched steel is harder on the surface than one oil quenched. When the same physical properties are desired, the drawback temperature after water quenching in regular axle practice is about 25 deg. C. higher than for oil, but in the test

made by Mr. Young the reverse is true, the oil-quenched axle having been drawn back at 15 deg. C. higher than the water.

Mr. Young emphasized that the time rate of cooling is the important point and not the medium. With the same drawing temperature, about 550 deg., the time for axles quenched vertically in agitated water was 6 min., and for quenching horizontally in oil, 35 to 40 min. He intimated that heat treatment of axles is pursued to secure the ductility of annealed forgings with 50 per cent higher elastic limit, and that the high drawing temperature is occasioned by the relation between the chemical composition and the physical requirements. The mechanical engineering department of the railroad sets the allowable fiber stresses, in the light of the experiences of failures, and asks for the longer elongation, so that Mr. Young owned to a belief that it would be a long time before forging steel with as low a ductility as 15 per cent would be acceptable.

Lawford H. Fry, Standard Steel Works Company, Burnham, Pa., as showing the influence of the conditions of quenching, told of the physical qualities of pieces of steel quenched in a bath without circulation and taking 20 min. and quenched in a bath agitated by means of compressed air and taking 10 min. In the former case, the elastic limit was 49,500 lb. per square inch, and in the latter 69,000 lb.; the ultimate strength was 95,000 lb. in the one and 105,000 lb. in the other; the elongation in the two cases was 20.5 and 21 per cent; the reduction of area, 43 and 42 per cent. With regard to the ductility factor, he mentioned that forgings subjected to alternating stresses and of 20 per cent ductility have been replaced satisfactorily by 15 per cent ductile forgings of 80,000 lb. elastic limit. As regards horizontal quenching, he had noted no difference from vertical quenching, the point being that with oil the cooling is relatively slow.

BOILER TUBE FAILURES AT HIGH TEMPERATURES

A paper by Prof. A. E. White and H. F. Wood on failures of tubes of steam boilers through recrystallization also developed considerable discussion. A review of the paper is given elsewhere in this issue. Prof. C. F. Hirshfeld, chief of the research department of the Edison Illuminating Company of Detroit, emphasized how the metal surfaces of large modern steam boilers are performing a duty two and three times that of previous practice, and the fact, he said, has brought numerous complications and may even mean the use of different boiler metals. In Detroit, where the troublesome tubes were in use, phenomenally pure water is available and it is used in distilled form. Yet an egg-shell scale is deposited and bagging of tubes results. One way out of the trouble suggested by the experiments is, he suggested, the use of higher carbon steel. The U. S. Navy, he mentioned, has been driven to the use of nickel steel.

F. N. Speller, metallurgical engineer, National Tube Company, believed the investigation showed no fault in the manufacture of the tubes, as if there had been original strain, the recrystallization would have been deeper. What recrystallization there was he regarded as hardly affecting as much as 5 per cent of the cross-section and accordingly there was a small loss in tensile strength of the tube. As showing the effect of temperature on the tensile strength, he told briefly the results obtained in his own laboratory on a 0.15 per cent carbon seamless tube. A maximum tensile strength of 65,000 lb. was obtained at 300 deg. C., but at 700 deg. the tensile strength was 10,000 lb. and at 800 deg. 7500 lb.

Professor White maintained that the recrystallization extended one-eighth of the distance from the fire side. He believed that once a higher carbon is rolled into the tube sheet, it will remain tighter, being less ductile. Dr. Howe doubted it would be necessary to consider very high carbon tubes; that with 0.12 per cent carbon steel, the 14 per cent of pearlite might serve as a bar to grain growth. Mr. Speller said it would be easy to supply 0.15 or 0.18 carbon tubes, but at Detroit the experience was with 0.11 per cent carbon steel.

SHEET CORROSION TESTS

The committee on corrosion of iron and steel submitted to the society last year a report giving the outline of a corrosion test which it proposed to make. The work is still in progress. The outline covered a great quantity of work, greater probably than the society realized, in the collection, inspection and analysis of sheets; erection of sheds, and final exposure of the samples, and also in obtaining the funds necessary for carrying on the work. The sheets of metal have been furnished and inspected and it was decided that all of the sheets which had been secured and analyzed should be exposed and additional sheets desired be obtained.

Tests and Testing

An entire evening was given to the discussion of tests and testing, much interest being taken in the various views presented on the relation between yield point and proportional limit in various grades of steel. This discussion carried one back to the earlier meetings of the society when the battle waged warmly between the late Gus Henning and others over the relation between yield point and elastic limit.

G. Lanza, chairman, presented the report of Committee E-1, on Methods of Testing, which recommended some slight changes in methods for tension and compression tests and inserted the following definitions of terms:

Elastic Limit is the greatest load per unit of original cross-section which does not produce a permanent set. (This determination is rarely made in the commercial testing of materials.)

Proportional Limit is the load per unit of original cross-section at which the deformations cease to be directly proportional to the loads. (This determination is rarely made in the commercial testing of materials.)

Yield Point is the load per unit of original area at which a marked increase in the deformation of the specimen occurs without increase of load. It is usually determined by the drop of the beam of the testing machine, or by the use of dividers.

YIELD POINT AND PROPORTIONAL LIMIT

The topical discussion on the relation between yield point and proportional limit followed the above-mentioned report. J. E. Howard, engineer-physicist of the Interstate Commerce Commission, the author of the first paper in this discussion, expressed a preference for the long-used term elastic limit, because of its definite meaning and because of the possibility that the alternative term proportional limit might include permanent sets of magnitude. He considered "yield point" to be vague and neither a desirable nor useful term to employ, but generally taken to mean a value above the elastic limit. Reference was made to the obscuring of elastic limit by initial strains in the steel.

T. D. Lynch, engineer of tests of the Westinghouse Electric & Mfg. Company, presented an elaborate and interesting series of curves, bearing on the relation between yield point and proportional limit. On the one hand were those showing a long and gradual curvature between proportional limit and yield point, in tests from untreated castings, heat-treated steel forgings and heavy plates finished hot at the rolls. The ratio of yield point to proportional limit in one of these was 144 per cent, 150 per cent in another, and as high as 189.6 per cent. Over against these were curves of short and relatively sharp curvatures between proportional limit and yield point, shown in tests from steel castings subjected to cold work in heat treatment, rounds finished relatively cold at the mill and from various grades of heat-treated steel. Here the ratio of yield point to proportional limit was close—102.9 per cent in one case, 103.8 per cent in another, and in others 104.2 per cent, 110.2 per cent, 107 per cent, 112 per cent and 121.2 per cent. He suggested to designers a careful study of the curves for different grades of steel and varying heat treatments and methods of manufacture, so that the load applied will always fall below the proportional limit of the material.

R. P. Devries, assistant physicist of the Bureau of Standards, continued the discussion with valuable sug-

gestions. He referred incidentally to yield point as giving some information which the engineer does not discard as to the ductility of the metal. There was also presented the written discussion of George R. Olshausen, who suggested that the terms elastic limit and proportional limit be both retained in order to indicate in what manner the determination of the limit was made. H. L. Morse favored the abandonment of elastic limit and the substitution of proportional limit, and at an earlier session Prof. H. M. Howe referred to the "passing of elastic limit."

C. D. Young said that after a long use of the term elastic limit, testing engineers are just coming to the point of determining what it is. There is to be considered first, the designer, who decides what material he will use. Then there is the engineer of tests, whose problem is to find in a few minutes for a large tonnage the same things found by the designer in tests extending over months. The intention of Committee A1 in defining elastic limit was to recognize in it a test which would give in a short time approximately what the designer had previously found—a recognition of the commercial side as well as the engineering side of the problem.

H. F. Moore and F. B. Seely presented a paper on "Constants and Diagrams for Repeated Stress Calculations," supplementary to their paper of last year on "Failures of Materials Under Repeated Stress."

A RAPID METHOD OF CORROSION TESTING

F. N. Speller, National Tube Company, gave an account of an accelerated method for testing the durability of pipe under corrosion, one he had used for two years in research work and which was not open to the objections made to the so-called acid test. The method duplicated conditions commonly found in service where pipe is subject to aerated water at a temperature of 140 to 180 deg. Fahr. under pressure, the only difference being in providing a continuous flow with the greater amount of oxygen and carbonic acid, thereby brought into contact with the interior surface of the pipe.

CENTIGRADE SCALE IN GOVERNMENT PUBLICATIONS

At the session devoted to tests and testing a resolution was passed on the recommendation of the executive committee, declaring it to be the sense of the meeting "that the effort to obtain legislation requiring the use of the Centigrade scale in all future Government publications be heartily approved." This resolution now goes to letter ballot. In connection with it A. A. Stevenson called attention to the fact that it was the first time the society had been asked to go on record on a matter of legislation.

ENDURANCE AND IMPACT TESTING

D. J. McAdam, Jr., gave an account of some methods of endurance and impact testing developed at the U. S. Naval Engineering Experiment Station at Annapolis, Md. The endurance test consists of alternating torsion applied to specimens of cylindrical test section and tapered fillets. It is likely to prove of considerable value in investigating metals. The appearance of the surface of the specimen during test may reveal any lack of uniformity in the material. The method of impact testing consists of the shearing of an unnotched specimen by impact applied by means of a swinging pendulum and the measuring of the energy used in the shearing. It has the advantage of applying a single kind of stress instead of a combination, of eliminating the uncertainty connected with unnotched specimens, and of making it possible to shear the same specimen several times and utilize the average results.

Non-Ferrous Metals and Alloys

W. H. Basset presented the report of committee B-1 on Copper Wire, in which it was stated that the work on tinned copper wire had been more of a task than was anticipated, particularly the formulation of tests to determine the thickness of the tin coat. By another year this matter will be covered by a formal report. On the recommendation of the committee the

tentative specifications for high strength bronze trolley wire were ordered submitted to letter ballot.

SPECIFICATIONS FOR NON-FERROUS METALS

Committee B-2, on Non-Ferrous Metals and Alloys, submitted five sets of tentative specifications, as follows:

- For copper plates for locomotive fireboxes.
- For copper bars for locomotive staybolts.
- For seamless copper boiler tubes.
- For seamless brass boiler tubes.
- For non-ferrous alloys for railroad equipment in ingots, castings and finished car and tender bearings.

In the last-named set were included steam metal, red brass, yellow brass and brazing metal. Several members representing interests having to do with railroad work took exceptions to the chemical composition provided for steam metal for cocks, valves, injectors and other castings. The range of tin in steam metal as provided in the proposed specification was 5 to 7 per cent. One interest suggested that the maximum be raised to 12. Other exceptions were taken to the steam metal, red brass, yellow brass and brazing metal analyses proposed and it was decided to re-submit these classes of railroad work alloys to the committee. Otherwise the proposed specifications were accepted for publication in the *Proceedings*. A revision of the standard specifications for spelter, as submitted by the committee was referred to letter ballot for adoption. In addition to high grade, intermediate, brass special and prime Western, originally provided for, a fifth grade is inserted between the last two, called "selected." Its limits are 0.80 per cent lead, 0.04 iron and 0.75 cadmium. It shall be free from aluminum and the sum of the lead, iron and cadmium shall not be more than 1.25 per cent. Changes were made also in the sections on sampling and analysis.

MANUFACTURE OF BRASS CONDENSER TUBES

A paper by A. E. White on "An Investigation Leading to Specifications for Brass Condenser Tubes" recited the work done by the author in seeking to remedy the frequent splitting of brass condenser tubes in service at the plant of the Edison Illuminating Company of Detroit. An abstract is given elsewhere. The specification developed as the result of his study was presented by Professor White and the statement was made that in over two and a half years since the recommendations submitted were acted upon no instance of a failed tube had come to light, while previously there were many days on which as many as five tubes out of the 20,000 in service at the Detroit plant had been either plugged or removed because of failure.

Exceptions were taken by W. Reuben Webster to some of the statements which Professor White had made. He did not consider that sufficient reason had been given for the choice of the formula 70 per cent copper and 30 per cent zinc. Maximum ductility would not be a sufficient reason. Mr. Webster thought that too much stress had been put on cold working. Hot worked tubing will give entirely satisfactory results. The specifications for the Navy Department do not impose the restrictions as to mechanical treatment which Mr. White had provided. No evidence had been furnished that bismuth is deleterious. Other exceptions were taken on behalf of manufacturers of tubes, which prompted the comment by Cloyd Chapman that if the manufacture of condenser tubes that will stand up in service was as easy as might be inferred from some of the statements made, it would be pertinent to ask why users have so much trouble with tube failures.

In closing the discussion Mr. White said that he had no desire for controversy with manufacturers, but would point out that since the specification he had presented had given the user condenser tubes which did not fail from splitting, whereas such failures had been common before, it was fair to say that it met the chief requirement of a good specification, namely, that a product manufactured in accordance with it has stood the test of service.

TESTS OF MANGANESE BRONZE AND ALUMINUM BRONZE

W. M. Corse and G. F. Comstock gave in a joint paper results of tension tests and endurance tests with the Landgraf-Turner and White-Southe machines made on manganese bronze and aluminum bronze, showing that although the former may give better figures when tested in tension, the latter is far superior in endurance of alternating stresses. A method of heat treatment was described by which the proportional limit of 10 per cent aluminum bronze was raised substantially, without the loss of too much ductility. This was shown to be applicable to castings of ordinary size. It increases endurance under alternating stresses as well as the proportional limit in tension.

A. A. Stevenson raised the question whether the society had not reached the point where it should recommend some standard magnifications for work with the microscope. The variations in magnification used in research work were commented on by several speakers. A resolution was passed asking the executive committee to appoint a committee on the subject.

Miscellaneous Materials

At the opening of the last session Dr. Richard Moldenke took the floor to pay tribute to Leslie S. Robertson, secretary of the British Standards Committee, who lost his life on the Hampshire. As a mark of respect the members rose.

The report of Committee A-3, on Cast Iron and Finished Castings, referred to some work by the subcommittee on carwheels which would be continued in the coming year, also to the attempt to form a subcommittee on specifications for cast-iron soil pipe and fittings. Tentative specifications have been circulated but without conclusions thus far. A recommendation was presented and adopted that the tentative methods of sampling and analysis of pig and cast iron published in 1915 be referred to letter ballot for adoption.

Dr. Moldenke also presented the report of Committee D-6, on Coke, recommending that the present tentative specifications for foundry coke be referred to letter ballot, and this was done. The report also submitted tentative methods for laboratory sampling and analysis of coke and these will be printed in the 1916 Year Book.

A paper by H. L. Morse was read by title, describing an apparatus for testing the standard cast-iron arbitration bar. It was designed by Mr. Morse for use on the 100,000-lb. Emery testing machine in the ordnance laboratory at Watertown Arsenal. The device utilizes the Ames dial by means of a thrust spindle and bell crank in such a way as to give an accurate measurement of deflection at the instant of fracture of the bar and at the same time avoid injury to the dial.

The last name registered on Friday brought the total of those attending the meeting up to 516.

Merger of Engine Parts Makers

The Steel Products Company and the Metals Welding Company, Cleveland, Ohio, and the Michigan Electric Welder Company, Detroit, Mich., three affiliated interests, have been merged in one company, which will bear the name of the Steel Products Company, and will have a capital stock of \$4,000,000. The products of the plants include valve stems and other gas-engine and automobile parts and welding equipment. The present officers of the Steel Products Company will remain at the head of the new company. They are C. E. Thompson, president; W. D. Bartlett, vice-president; and J. A. Krider, secretary and treasurer. Additional directors are E. C. Rader, C. F. Clarke, C. N. Osborne and S. Livingston Mather. The other merged companies will operate under their own names as subsidiary plants.

The Swind Machinery Company, dealer in new and second-hand machinery and tools, has removed its office and salesroom from the Bourse Building, Philadelphia, to room 1110 Widener Building.

SPRAY COOLING PONDS

A Feature in Converting a Small Mill Steam Plant to Condensing Operation

Small mill power plants, operated non-condensing on account of lack of cooling water, could, by installing a small earthen pond or concrete basin fitted with a spray cooling system effect a net saving in the cost of power of from 15 to 20 per cent, according to Lee H. Parker, president of the Spray Engineering Company, Boston, in a paper read some time ago before the National Association of Cotton Manufacturers. The most important feature of such a system are the nozzles, whose function is to produce a fine spray at the outlet, with a low operating pressure and without clogging. The nozzles are of high-grade bronze finished smooth inside and out. The piping is generally of cast iron with flanged connections, valves and fittings. Such a system, Mr. Parker says, resting on concrete piers will have an indefinite life with practically no maintenance cost.

The average loss of water from evaporation has been determined by tests to be about 1½ per cent of the water sprayed in New England installations and about 2 per cent in the Southern states, the higher figure in the latter case being due to the greater evaporation at the higher atmospheric temperatures. The average amount of heat dissipated from the surface of a natural-cooling pond, provided with partitions to force the water to travel as long a distance as possible between intake and outlet, has been shown to be 3.5 B.t.u. per square foot per hour per degree of temperature difference. The average heat dissipated by a spray cooling pond is given as 127 B.t.u. per square foot per hour per degree of temperature difference. Thus a natural cooling pond, capable of taking care of a 100-hp. plant, can be made to take care of a 3600-hp. plant by the addition of a spray cooling system.

With cooling ponds of any type the feed water for the boilers is taken from the pipe line and the pond, thus saving the heat in that portion of the condensing water returned to the boilers. It is important to have the ratio of condensing water to steam condensed large enough to keep the water in the pond in equilibrium for any desired vacuum. If this ratio is such that the heating effect of the condenser is greater than the cooling effect of the pond, the temperature of the pond will rise and the vacuum decrease correspondingly, thus impairing the economy of the plant.

When there is no breeze, an upward air current is created around each nozzle due to the combined effect of the movement of the spray and the heating effect of the spray on the air. This current carries away rapidly the warm moist air, which is replaced by cool air from the surface of the pond. Spray ponds are more efficient in extremely hot weather with high humidity than in cool weather with low humidity. The following table shows typical results obtained with spray ponds.

Air Tem- perature, Deg. Fahr.	Relative Humidity, Per Cent.	Temperature of Water, Deg. Fahr.		Season of Year
		Before Spraying	After Spraying	
18	72	100	60	Winter
20	..	104	63	Winter
22	..	105	64	Winter
24	..	107	65	Winter
26	..	108	66	Winter
30	..	110	66	Winter
56	..	99	82	Spring
59	79	100	85	Spring
62	..	101	86	Spring
64	..	103	88	Spring
66	..	104	88	Spring
70	..	105	88	Spring
69	..	104	87	Summer
71	40	108	92	Summer
75	..	110	94	Summer
78	..	112	96	Summer
88	..	114	98	Summer
90	70	108	90	Summer
98	..	118	93	Summer
85	32	86	76	July
93	19	90	80	July

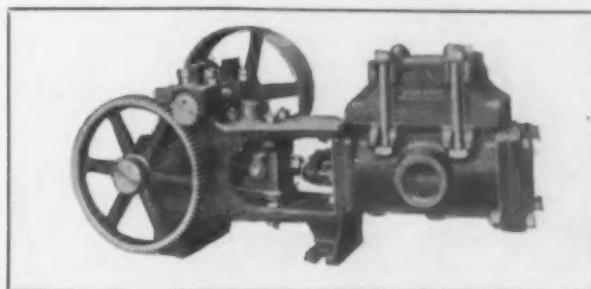
The above results were obtained with single spraying. Greater cooling effects could be obtained by successive sprayings or by mixing a portion of the cooled

water with the hot water in the discharge line, and spraying the mixture at the resulting average temperature. To determine whether or not a cooling system will pay, it is only necessary to compare the cost of city water used for condensing, or the cost of pumping, if the water is obtained from a distant source, with the fixed charges on a cooling system plus the costs of operation and maintenance.

An Improved Design in Power Pumps

A general utility power pump has recently been added to the line of pumps manufactured by Bean Brothers Steam Pump Works, Indianapolis, Ind. The power frame is a separate casting, not cast integral with the pump cylinder. Suction and discharge valves are contained in separate valve plates, which are renewable at small expense, and can be removed for examination without disturbing piping or breaking any permanent joints. This feature is especially advantageous when strong corrosive acids, as liquids containing sulphur or strong alkalis, are being handled. The piston is the two-piece, packed type, using square duck packing. The water cylinder is brass lined and the removal of the four outside bolts makes all valves immediately accessible without the use of special wrenches.

The power end is notably simple. All bearings, which are lined with babbitt, have removable shims, allowing the cups to be set closer when it becomes nec-



General Utility Type of Pump Brought Out by Dean Brothers Steam Pump Works

essary to take up wear. The bearings have lubricating devices with adjustable sight feed and capacity for a full day's run. The crankshaft and connecting rod are of drop forged steel of high tensile strength. The cross head is of the plain box type working in slides that are adjustable for wear and easily renewable, a feature for small power pumps. The gears have machine cut teeth instead of cast teeth.

At 92 r.p.m. this pump delivers 36 gal. per minute. The pump is guaranteed to operate against pressures up to 60 lb. per square inch. In a shop test of 120 days' duration, the pump operated against 60-lb. pressure for 90 days and against 80-lb. pressure for 20 days. The discharge valve was then closed down and the pressure mounted to 240 lb., when the valve was opened. The pressure was then increased to 90 lb. and the pump operated against this pressure for 10 days. On completion of the test bearings were found in good condition and gear teeth indicated no signs of wear.

Carpenter Steel Adds to Open-Hearth Capacity

The Carpenter Steel Company, Reading, Pa., will build two stationary basic 10-ton open-hearth furnaces, with auxiliary equipment, to increase its capacity for making special steels. The company now has in operation four 32-pot crucible furnaces, one 10-ton basic open-hearth furnace, and one 6-ton Heroult electric furnace. Previous to the installation of the electric furnace, its plant had an annual capacity of 10,000 tons of crucible ingots and 10,000 tons of open-hearth ingots.

After a long idleness, the puddle mill and the butt-weld department of the pipe mill of the Susquehanna Iron Company, Columbia, Pa., now under lease to the A. M. Byers Company, resumed operations July 5.

Judicial Decisions

ABSTRACTED BY A. L. H. STREET

LIABILITY CONCERNING PORTABLE BRIDGEWAYS.—The rule of law which requires an employer to provide a reasonably safe place of work for his employees extends to a removable bridgeway placed between a factory building and railroad cars in loading and unloading freight, and the employer is liable for injury caused by displacement of the bridgeway through want of a cleat to prevent its slipping, the injured man not being chargeable with notice of the defective condition, and being entitled to assume that his employer had taken all steps reasonably necessary to avoid such an accident. (Kentucky Court of Appeals, Reffitt vs. Southern Sheet & Tin Plate Company, 186 Southwestern Reporter, 155.)

AMOUNT RECOVERABLE BY INJURED MOLDER.—A verdict for \$8,109.20 in favor of an injured molder is not excessive when it appears that his hand has been badly crippled in an accident attributable to fault of the employer, requiring him to see much less remunerative employment. (Pennsylvania Supreme Court, Freed vs. Standard Scale & Supply Company, 97 Atlantic Reporter, 72.)

WAIVER OF LIEN ON ORE.—Sales agents for an iron mining company who had a contracted lien on ore produced by the company for advances could not, on selling some of it, assert a lien against a different kind of ore bought on behalf of the company, the lien being discharged by sale of the company's produced ore. (United States Circuit Court of Appeals, Second Circuit, Hillman vs. New York State Steel Company, 231 Federal Reporter, 936.)

STEAMSHIP COMPANIES' LIABILITY CONCERNING FREIGHT.—A steamship company accepting a shipment of articles crated in a customary manner, which had previously proved safe and sufficient, was bound to stow the freight with reference to the weight of the articles and the manner of crating, and is liable for injury to the shipment resulting from piling in too high tiers. A stipulation releasing a ship from liability for injury to freight resulting from "perils of the sea" does not relieve from responsibility for loss resulting from storms of no greater severity than are reasonably to be expected, considering the route, season and known manner in which the freight has been packed. (United States District Court, Northern District of California, the Erskine M. Phelps, 231 Federal Reporter, 767.)

UNSAFE CONDITION OF WAREHOUSE PREMISES.—One going to a warehouse on business, but using another than a customary door and finding his passage obstructed and dark, is not entitled to recover damages resulting from falling down an elevator well which was unguarded; an owner of premises not being bound to keep them safe as to places to which persons are not expressly or impliedly invited to go. (New York Supreme Court, Appellate Division, Miller vs. Barker, Rose & Clinton Company, 158 New York Supplement, 865.)

EXCUSE FOR SELLER'S DELAY IN DELIVERY.—When, in an action by a seller to recover the agreed price of equipment, the buyer counterclaims damages for failure of the seller to deliver within an agreed time, the latter is entitled to show in rebuttal that the delay resulted from the buyer's own breach of contract. (Kentucky Court of Appeals, Lam vs. Earlington Machine Works, 186 Southwestern Reporter, 152.)

CONTRIBUTORY NEGLIGENCE OF EMPLOYEE.—A steel company's stationary engineer who pried an engine's fly-wheel to get the engine off "dead center" while the steam was on was guilty of contributory negligence, which bars recovery for injury resulting from being struck by the bar used in the prying when the engine started. (Pennsylvania Supreme Court, Kephart vs. Carbon Steel Company, 97 Atlantic Reporter, 574.)

EMPLOYERS' LIABILITY ACTS.—The Oklahoma law which requires employers to safeguard dangerous machinery, such as revolving set screws, etc., does not render them liable for injuries resulting from an un-

guarded condition but directly attributable to the injured man's own contributory negligence. (Oklahoma Supreme Court, Kester vs. Enid Mill & Elevator Company, 157 Pacific Reporter, 355.)

GUARANTEED CAPACITY OF PUMPS.—A buyer of a pump sold under warranty of its capacity to lift a certain quantity of water per minute, under certain conditions relating to the flow of clear water in the well, is not entitled to recover damages on the theory of failure of the pump to come up to the warranty, in the absence of proof that the well furnished enough clear water to meet the guaranteed capacity of the pump. (California District Court of Appeals, Fairbanks, Morse & Co. vs. Zimmerman, 157 Pacific Reporter, 509.)

RECOVERY UNDER KANSAS COMPENSATION ACT.—Recovery can be had under the Kansas workmen's compensation act only on the basis of disability to labor resulting from the injury received in the course of employment, without the intervention of any independent cause, the separate consequences of which admit of definite ascertainment. It cannot be augmented by the fact that the disabling effects of the injury are increased or prolonged by incompetent or negligent surgical treatment, even where the employer is responsible therefor. (Kansas Supreme Court, Ruth vs. Witherspoon-Englar Company, 157 Pacific Reporter, 403.)

AN EXEMPTION FAVORING INTERSTATE COMMERCE.—A contract for sale of machinery to be installed in Wisconsin, formed by a Minnesota machinery company's acceptance in Minnesota of an order given by the buyer, the machinery being shipped from the latter mentioned State, constitutes interstate business not affected by the Wisconsin statute which prohibits suit in Wisconsin on contracts made in that State by a non-resident corporation which has not complied with the Wisconsin statutes limiting the right of foreign corporations to do business in that State. (Wisconsin Supreme Court, Charles A. Stickney Company vs. Lynch, 158 Northwestern Reporter, 85.)

EMPLOYEE ASSUMES OBVIOUS RISKS.—An employer's direction to a workman to perform a dangerous task will not render the former liable for injury resulting from an apparent defect in an appliance which the employee is required to use. (Georgia Court of Appeals, Niblett vs. La Grange Mills, 88 Southeastern Reporter, 1009.)

RECLAIMING PROPERTY CONDITIONALLY SOLD.—One who sells chattel property under a contract reserving title until payment of the purchase price, as evidenced by notes given therefor, does not lose the right to reclaim the property on non-payment of notes remaining in his hands by reason of transferring part of the notes; but the buyer is entitled to cancellation and delivery of all unpaid and outstanding notes. (West Virginia Supreme Court of Appeals, Orenstein-Arthur Koppel Company vs. Martin, 88 Southeastern Reporter, 1064.)

WHEN SELLER DOES NOT IMPLIEDLY WARRANT Goods.—When a buyer of goods accepts them after inspection, or after opportunity to inspect them, there is no implied warranty on the part of the seller as to the quality or merchantableness of the goods. (West Virginia Supreme Court of Appeals, Showalter vs. Chambers, 88 Southeastern Reporter, 1072.)

SALE OF MACHINERY ON TRIAL.—When machinery is sold on trial for a certain period, the buyer retains it beyond that time, and the seller sues for the price, title will be held to have passed from the seller to the buyer. But as long as there is nothing to show that the parties have expressly or impliedly agreed that the trial shall be merged into an absolute sale, the right remains in the seller to reclaim the property on insolvency of the buyer and his non-payment of the price. If no period of trial be fixed, the mere fact that the buyer has retained possession nearly two years will not preclude the seller from recovering possession on the theory that there was no absolute sale. And when a machine is sold on trial, but no price is fixed, either party may rescind the contract at any time before a price is agreed upon. (Delaware Court of Chancery, James Bradford Company vs. United Leather Company, 97 Atlantic Reporter, 620.)

